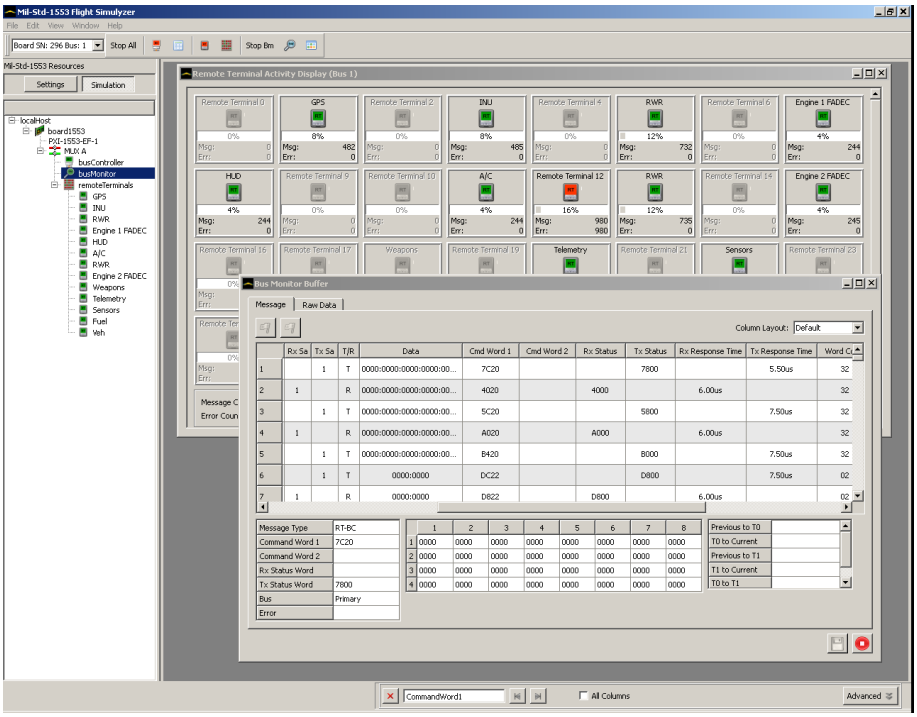
Avionics Interface Technologies

Flight Simulyzer

Graphical User Interface



Nov. 2011

v01.03.00

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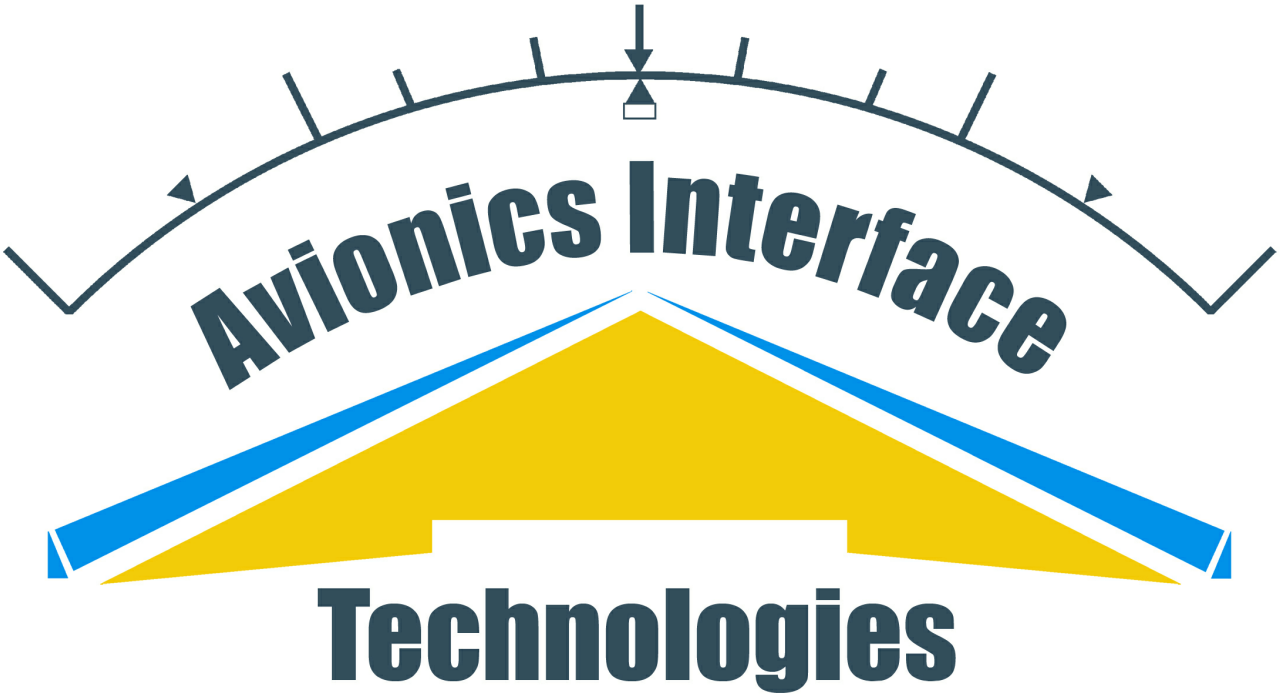


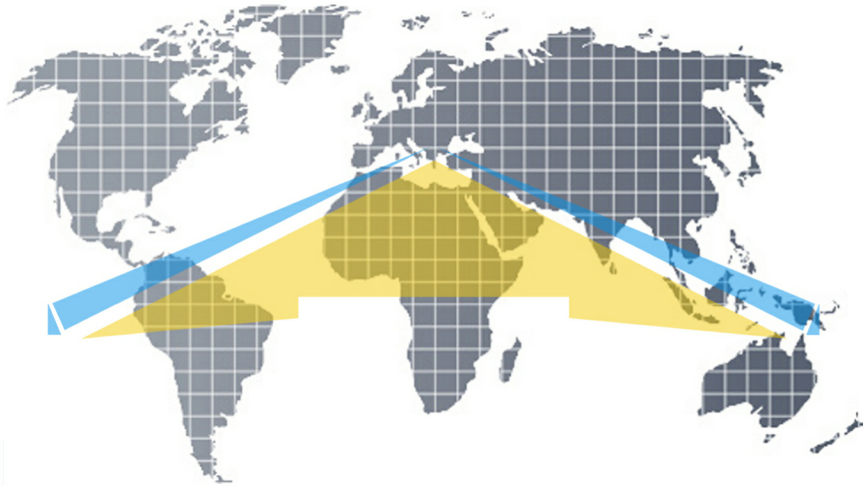
Flight Simulyzer

Quick Start Guide

Graphical User Interface

v01.03.00

Nov. 2011



Avionics Interface Technologies

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Table of Contents

1 Introduction

The *Flight Simulyzer* User's Guide is designed to provide an unfamiliar user with a functional overview of the operation of AIT's Graphical User Interface (GUI) Analyzer Software. This manual presents the current version of *Flight Simulyzer* from a feature overview through initial setup options.

Software installation of the Device Driver and Application Programmer's Interface (API) requirements are defined followed by a descriptive layout of the Main Window environment. In the MIL-STD-1553 portion of this document, the basic 1553 Bus Controller (BC), Remote Terminal (RT), and Chronological Bus Monitor (BM) functions are discussed in some detail to provide the user with a familiarity of the functionality of the software. The Arinc664 portion of the document provides information about creating complete 664 End System configurations. The ARINC-429 portion of the document provides information about creating complete 429 Device and Transmit/Receive channel configurations.

Document History

Version	Date	Author	Description
V01.00.00	March 2011	K. Bisson	Creation of document, written for *Flight Simulyzer* v01.1.0
V01.01.00	April 2011	T. Troshynski	Updated with additional information about BC, RT, BM operations.
V01.02.00	July 2011	J. Cole	Updated screenshots and added information for latest features.
V01.03.00	Nov. 2011	J. Cole	Reorganized manual to reflect multiple bus standards and added Arinc664 configuration help.
V01.04.00	Nov. 2011	T. Fleissner	Updated with screenshots and added additional information for ARINC-429 features

1.1 How This Manual is Organized

This Manual is comprised of the following sections:

- **Introduction:** contains an overview of this manual.
- **Installation:** describes the steps required to install *Flight Simulyzer*.
- **Basic Operation**: describes the basic functionality of *Flight Simulyzer* that is generic to the utilized protocol.
- **ARINC-664**: describes the Arinc664 portion of the software.
  - **Features**: gives an overview of the 664 related features
  - **Device**: describes the Device configuration settings

- **End System:** describes the End System configuration settings.
- **Vl_and_Port_Configuration**: describes the settings for Virtual Link and Communications Ports

- **MIL-STD-1553:** describes *Flight Simulyzer* with respect to configuring and simulating 1553 hardware.
  - **Features:** gives an overview of the 1553 analyzer features.
  - **Bus Configuration**: describes the bus configuration settings.
  - **Bus_Controller:** describes BC configuration and simulation functionality.
  - **Remote_Terminal:** describes RT configuration and simulation functionality.
  - **Bus_Monitor:** describes BM configuration and simulation functionality
  - **Running a simulation:** describes starting a 1553 simulation.
- Notes: contains industry and product-specific definitions, acronyms and abbreviations.

1.2 Applicable Documents

The following documents shall be considered to be a part of this document to the extent that they are referenced herein. In the event of conflict between the documents referenced and the contents of this document, the contents of this document shall have precedence.

- MIL-STD-1553B Digital Time Division Command/Response Multiplex Data Bus (US DOD Sept. 1978
- AIT MIL-STD-1553 Protocol Tutorial

2 Installation

This section describes the system requirements, device driver installation, and describes the installation process for *Flight Simulyzer*.

2.1 Minimum System Requirements

- x86 300MHz CPU
- 128 MB RAM
- 30 MB available Hard disk space
- 500 MB+ available Hard disk space for recording
- Windows XP / Vista / 7
- Monitor resolution: 800 x 600 pixels with 256 colors

2.2 API Device Driver Requirements

For simulation functionality, *Flight Simulyzer* requires properly installed AIT Device Drivers to operate correctly. During the installation process these drivers can be installed, or they may be installed separately.

Refer to the pertinent **AIT Hardware Manual** for details on installing the correct driver files for the specific Operating System and your hardware.

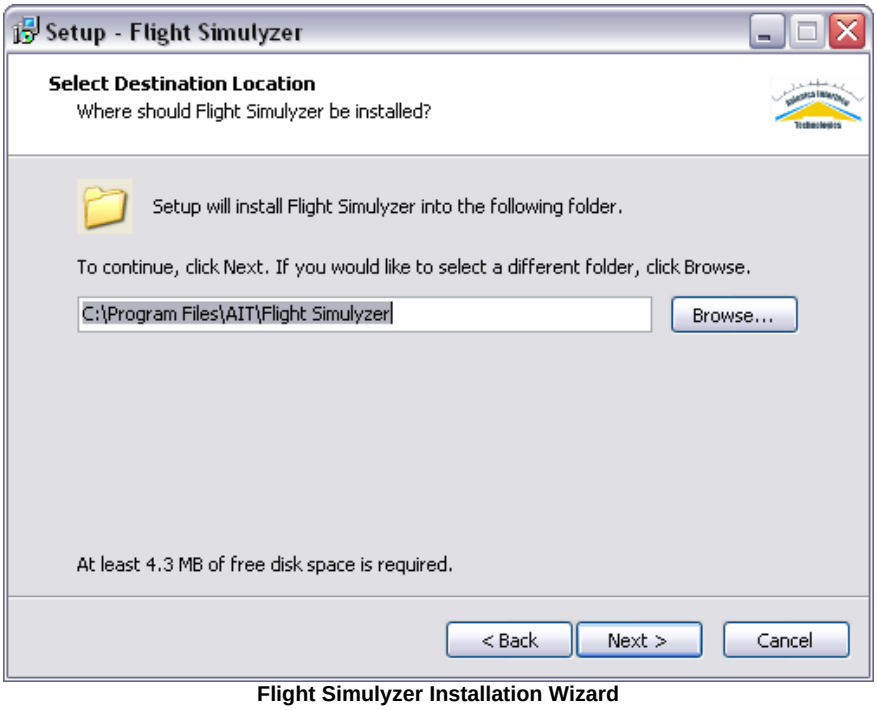
2.3 Flight Simulyzer Software Installation

- To install the *Flight Simulyzer* software:

  1. **Insert** the *Flight Simulyzer* CD into the CD ROM drive.

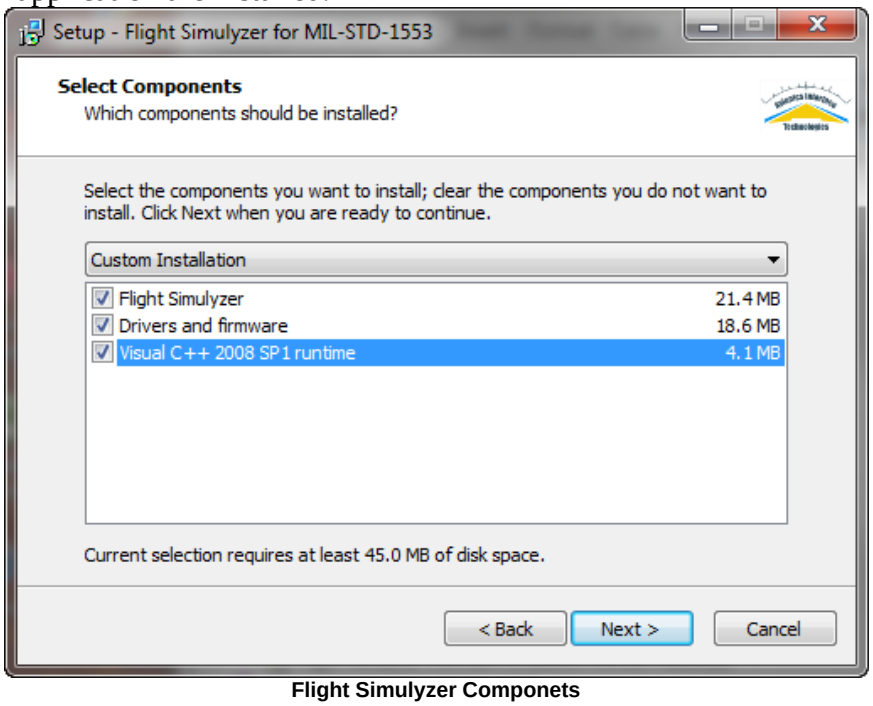
  2. After a few seconds, the setup application will automatically start. If the Setup application does not automatically start, you may manually start it by running the file flight-simulyzer-x.x.x-**.exe** found on the *Flight Simulyzer* CD.

  3. Once the setup has started, step through the **Install Wizard** to complete the installation. The wizard will give you the opportunity to choose the directory in which *Flight Simulyzer* is installed and the Program Folder in which the *Flight Simulyzer* shortcut will be placed. Default locations can also be used.



Flight Simulyzer Installation Wizard

4. During installation, it is possible to select which components of the application are installed.



Flight Simulyzer Componets

The table below summarizes the components of the Flight Simulyzer installation:

Component	Description
Flight Simulyzer	The GUI application and its supporting libraries and documents
Drivers and Firmware	The hardware module drivers and firmware. If the Flight Simulyzer GUI is NOT going to be used with the hardware (i.e. it will only be used to create, export, and edit configuration files) then this component may not need to be installed.
Visual C++ 2008 SP1 runtime	The Windows VC++ runtime required by the Flight Simulyzer application. This may be necessary if your host system is not updated to the latest OS service pack.

5. Once the installation is complete, a shortcut to the *Flight Simulyzer* application can be launched from the Start menu (**Start | All Programs | Avionics Interface Technologies | Flight Simulyzer | Flight Simulyzer**).
6. If you purchased a license key for simulation, the license key will automatically get installed to /Program Files/AIT/LicenseKeys/FlightSimulyzer.

2.4 Detecting hardware

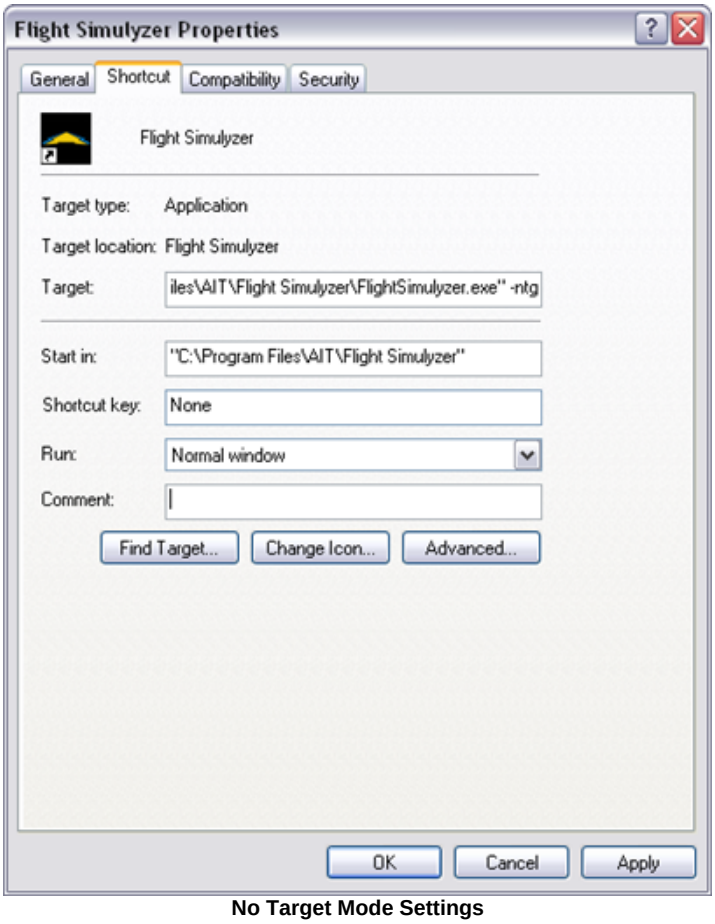
Flight Simulyzer by default allows creation of hardware configuration files without hardware installed. If no hardware is detected or no *Flight Simulyzer* license key is found for your hardware, a message indicating "No Licensed Hardware Available" will be displayed in the simulation resource window. If you do not need simulation functionality, you can ignore this section.

If you purchased a license key for *Flight Simulyzer*, the license key, if included on the installation CD, will be automatically installed to /Program Files/AIT/LicenseKeys/FlightSimulyzer at software installation time. If the license key was installed to this directory and you still see the "No Licensed Hardware Available" message, or you need a license key, please contact Avionics Interface Technologies. If you have licensed hardware in your system, and you would like to force *Flight Simulyzer* into "No Target Mode", do the following:

1. **Right click** on the installed *Flight Simulyzer* Desktop icon or system Start menu item and select **Properties**.

2. **Add** *(space)*-ntg to the end of the target file name, as seen in the figure

below. This will prevent *Flight Simulyzer* from trying to detect hardware.



No Target Mode Settings

3 Basic Operation

Perspectives

Flight Simulyzer has two main "perspectives" for configuring and simulating the various AIT hardware devices compatible with the software.

Settings

The *Settings* perspective, navigated to by clicking the Settings button, is available for configuring hardware directly, or for import or export to xml, binary, or hex format (depending on the hardware type). Please see the section(s) for the protocol(s) with which you are working for information on how to configure the hardware.

Simulation

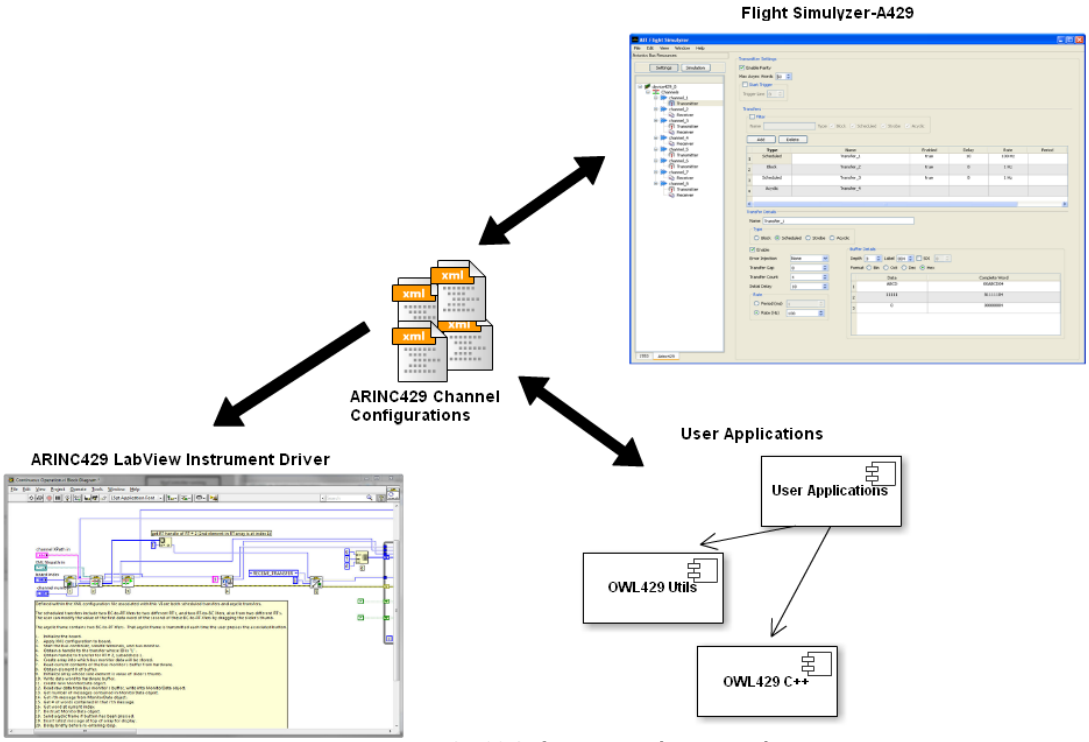
The *Simulation* perspective, navigated to by clicking the Simulation button, is available for simulating hardware, as configured in the *Settings* perspective. In order to perform a simulation, your hardware must be correctly licensed. See the Detecting hardware section for information about utilizing hardware with *Flight Simulyzer.* Not all AIT hardware is currently supported for simulation.

Within each perspective is the option for the various available protocols. By changing the protocol tab, you will be able to configure and/or simulate the hardware for your application.

4 ARINC-429

The *Flight Simulyzer* Analyzer Software can currently be used to create configurations for AIT's ARINC-429 hardware modules. An easy-to-use GUI allows complete visual programming that enables users to optimize, plan, and configure complete ARINC-429 channels.

Flight Simulyzer's Transmit and Receive channel configurations are based on a common data format (XML) which allows simulation setups created and used within the *Flight Simulyzer* application to also be loaded and executed from within the AIT ARINC-429 LabVIEW Instrument driver and high-level C/C++ application interface libraries.



AIT ARINC-429 Software Development Kit

4.1 Features

- Visually configure ARINC-429 Devices, including Rate Oriented Transmit and Receive Monitor Channels
- Import and export configuration files for A429 Devices and individual channels.

4.1.1 Rate Oriented Transmit Channel

- Intuitive, easy-to-use user interface for defining rate oriented labels, block transfers, and acyclic transfers in Milliseconds or Hertz
- Programmable High/Low Speed Operation

- Internal Receive functionality to transmit and receive data on the same channel
- Automatically calculate parity or use parity bit as data

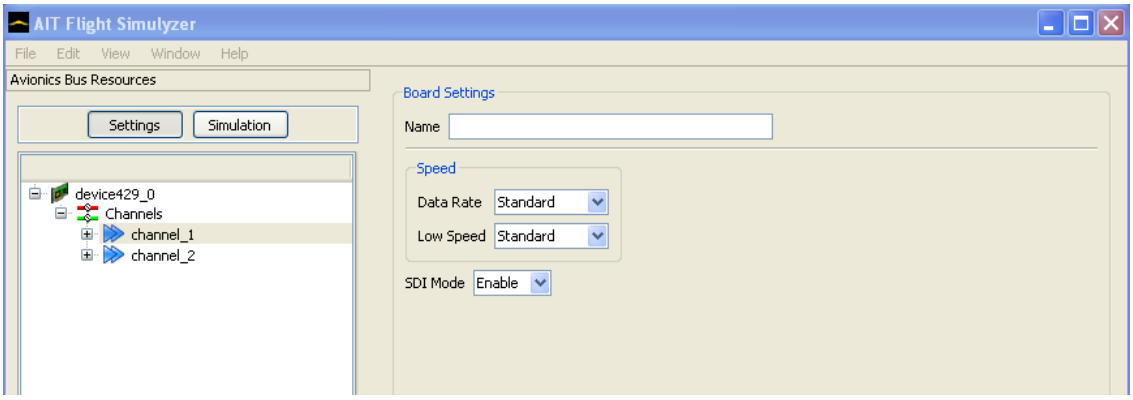
4.1.2 Receive Monitor Channel

- Chronological Monitor to receive all data on a channel basis
- Define label buffers to receive only data for a specific label
- Define simple filters to receive only specific label or label/sdi combinations

4.2 Board

Configuration Options

This section describes the configuration options for ARINC-429 Devices. In the *Settings* perspective, the selection of a Device node changes to the Device configuration context. There are 3 major configuration blocks related to the configuration at the Board level: name, speed, and SDI mode.



Item	Description
Name	The name to associate with the given Board
Data Rate	Configures the data rate modifier for high and low speed channels
Low Speed	The low speed selection for all channels id configured for low speed
SDI mode	Indicates whether the SDI is included when the receiver sorts the received data

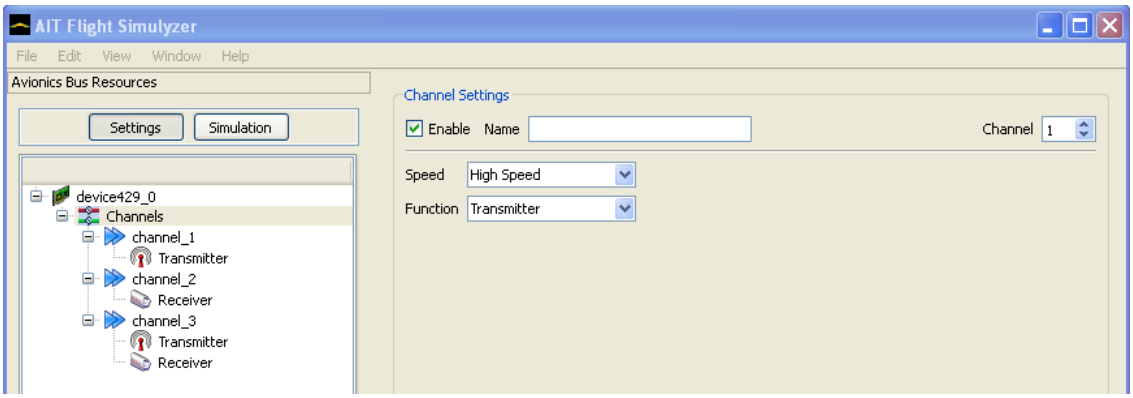
Import/Export

Board configurations can be imported and exported to AIT's XML format for use in the High Level C/C++ APIs or the LabVIEW Instrument Driver. The *Export* Button allows the configuration to be saved to a XML or Binary File, while the *Import* allows a XML or Binary Configuration File to opened in the GUI for editing.

4.3 Channel Settings

Configuration Options

This section describes the configuration options for ARINC-429 Channels. In the *Settings* perspective, the selection of a Channels node changes to the Channels configuration context. There are 4 major configuration blocks related to the configuration at the Channel level: Enable, Name, Speed, and Function.



Each Channel has the following items that are configurable:

- **Enable**: Enables the selected channel
- **Name**: The name to associate with the given Channel
- **Speed**: Specifies whether the channel is High or Low Speed

Speed	Description
High Speed	Channel configured with a speed of 100 kHz
Low Speed	Channel configured with a speed of 12.5 kHz

- **Function**: Specifies the type of channel: Transmitter, Receiver, or Transmitter plus Monitor

Function	Description
Transmitter	Channel is configured to transmit the label/data combinations with the given rates
Receiver	Channel is configured to receive data in a chronological monitor or on a per label basis
Transmitter plus Monitor	Channel can act as a transmitter and receiver. The internal loopback functionality can be used to transmit and receive on the same channel.

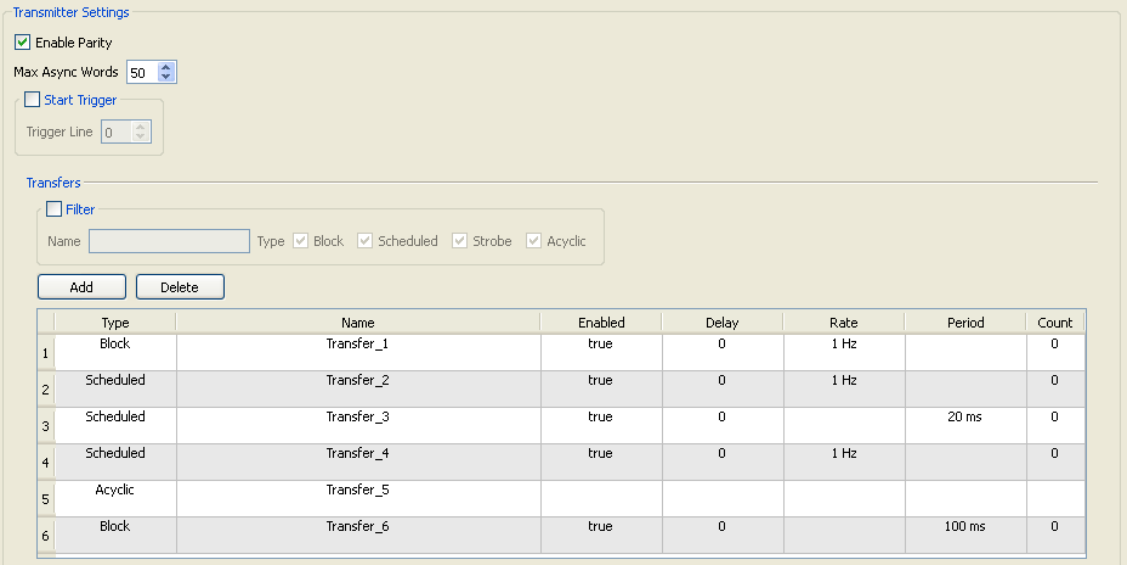
Import/Export

Channel configurations can be imported and exported to AIT's XML format for use in the High Level C/C++ APIs or the LabVIEW Instrument Driver. The *Export* Button allows the configuration to be saved to a XML or Binary File, while the *Import* allows a XML or Binary Configuration File to opened in the GUI for editing.

4.3.1 Transmitter Settings

Configuration Options

This section describes the configuration options for ARINC-429 Transmit Channels. In the *Settings* perspective, the selection of a Transmitter node changes to the Transmitter configuration context. Within the Transmitter configuration context, three different transfers can be configured: Scheduled Labels, Block Transfers, and Acyclic Transfers. For each of these transfers, different properties can be configured to achieve the desired schedule.



Each available Transmit Channel of the hardware device can be individually configured. Mainly with types of transfers, but there are a couple of other configurable properties according to the specific configuration:

- **Enable Parity**: Specifies whether parity should automatically be calculated and appended to the transfer or the 32 bit is used as data

- **Maximum Asynchronous Words**: Specifies the maximum size of the asynchronous buffer that can be allocated for asynchronous sends

Adding and Deleting Transfers

- To Add or Delete transfers, Click the **Add** or **Delete** buttons

1. Once the Transfers are added, specify the type, name, delay, rate or period, and transfer count
   Note: If a transfer is added with the same configuration twice, the row will appear in red

Item	Description
Type	Type of transfer: Block, Scheduled Label, or Acyclic
Name	The name to associate with the given Transfer
Enabled	Specifies whether the transfer is initially enabled or disabled
Delay	Initial delay(ms) before the transfer starts regular cyclic transmission
Rate	Periodic Rate, in Hertz, the transfer will take place
Period	The time interval, in milliseconds, between transfers
Count	Sets the number of times the transfer is transmitted.

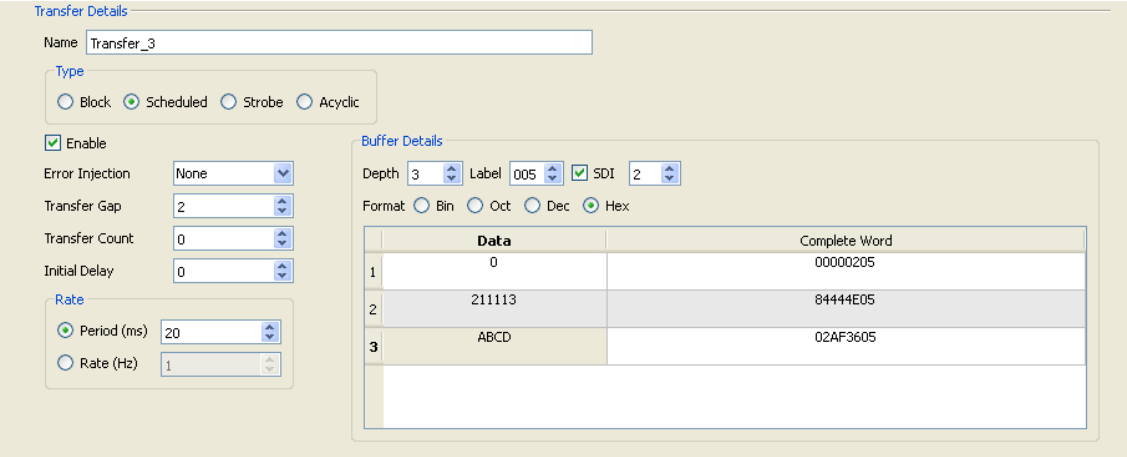
Note: Only the Rate or Period should be set, NOT both

- In order to filter the table to only view the certain transfers, check the Filter box and specify the name or transfer type.

4.3.1.1 Scheduled Labels

Configuration Options

This section describes the configuration options for Scheduled Labels that can be configured on transmit channels. When the row is clicked in the transfer table shown in the Transmitter Settings section, additional options will be shown that allow configuration for the scheduled label. Mainly the Label, Data, and Rate are what is typically configured for a scheduled label but additional options can also be set.



Transfer Details

Each available Scheduled Label has the following items that are configurable:

- **Name**: Specifies the name to associate with the scheduled label
- **Type**: This is set to scheduled label for this type of transfer.
- **Enable**: Specifies whether the label is initially enabled or disabled.
- **Transfer Gap**: Sets the width of the inter-message gap in bits.
- **Transfer Count**: Specifies the number of times the message is transmitted. A value of zero means cyclic transmission

- **Initial Delay**: Initial delay before the transfer starts regular cyclic transmission
- **Rate**: Specifies the rate/period that the transfer will take place
    1) **Period**: Time Interval in milliseconds between transfers
    2) **Rate**: Periodic Rate in Hertz the transfer occurs

Buffer Details
A buffer is associated with each scheduled label to determine the data that is transmitted with the label. Within the buffer configuration, the depth, label, sdi, and data can be specified.

- **Depth**: Specifies the number of data combinations are associated with this label
- **Label**: The value of the label that is sent with the data
- **SDI**: The value of the SDI within the data field
- **Data**: Sets the value of the remaining data bits depending if parity is enabled and SDI is specified.

Note: If the data field is longer than the remaining number of bits available, the row will appear in red.

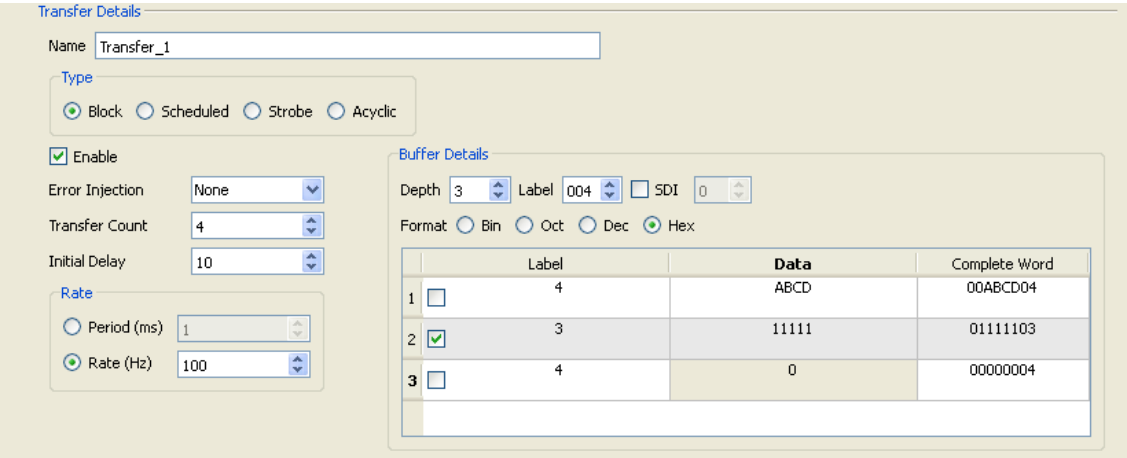
Depending on the values specified in configuration, the **Complete Word** section of the table will calculate and show the complete data word that will be transmitted.

The Buffer can be viewed in 4 of the following formats: Decimal, Hexadecimal, Octal, and Binary.

4.3.1.2 Block Transfers

Configuration Options

This section describes the configuration options for Block Transfers that can be configured on transmit channels. When the row is clicked in the transfer table shown in the Transmitter Settings section, additional options will be shown that allow configuration for the block transfer. Mainly the Label, Data, and Rate are what is typically configured for a block transfer but additional options can also be set. Additionally, a block transfer can be configured to transfer different Label/Data combinations, the same label does not have to be used for each buffer entry.



Transfer Details

Each available Block Transfer has the following items that are configurable:

- **Name**: Specifies the name to associate with the scheduled label
- **Type**: This is set to block for this type of transfer.
- **Enable**: Specifies whether the label is initially enabled or disabled.
- **Transfer Count**: Specifies the number of times the message is transmitted. A value of zero means cyclic transmission
- **Initial Delay**: Initial delay before the transfer starts regular cyclic transmission
- **Rate**: Specifies the rate/period that the transfer will take place
    1) **Period**: Time Interval in milliseconds between transfers
    2) **Rate**: Periodic Rate in Hertz the transfer occurs

Buffer Details

A buffer is associated with each scheduled label to determine the data that is transmitted with the label. Within the buffer configuration, the depth, label, sdi, and data can be specified.

- **Depth**: Specifies the number of data combinations are associated with this transfer
- **Label**: The value of the label that is sent with the data, unless overwritten in the table
- **SDI**: The value of the SDI within the data field
- **Data**: Sets the value of the remaining data bits depending if parity is enabled and SDI is specified.

Note: If the data field is longer than the remaining number of bits available, the row will appear in red.

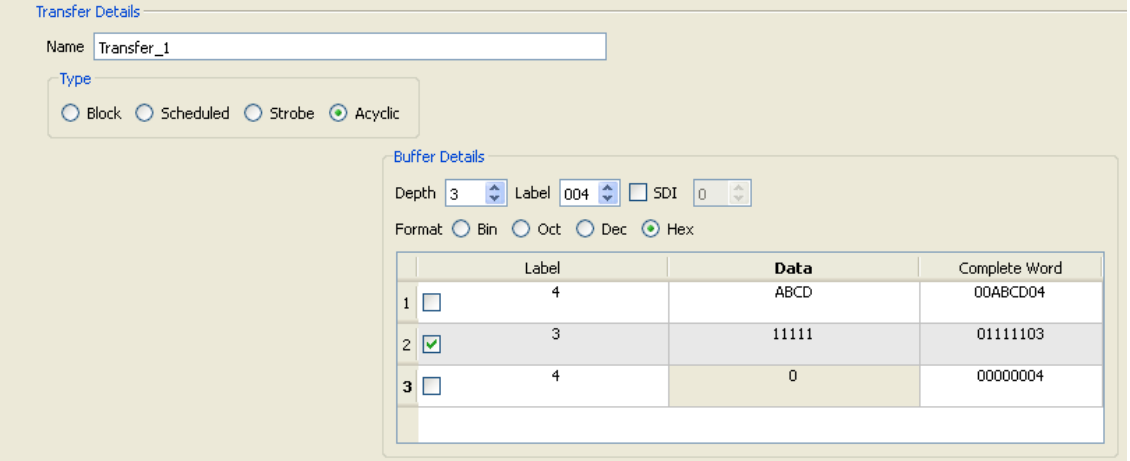
Depending on the values specified in configuration, the **Complete Word** section of the table will calculate and show the complete data word that will be transmitted.

The Buffer can be viewed in 4 of the following formats: Decimal, Hexadecimal, Octal, and Binary.

4.3.1.3 Acyclic Transfers

Configuration Options

This section describes the configuration options for Acyclic Transfers that can be configured on transmit channels. When the row is clicked in the transfer table shown in the Transmitter Settings section, additional options will be shown that allow configuration for the acyclic transfer. Mainly the Label and Data are what is typically configured for an acyclic transfer but additional options can also be set.



Transfer Details

Each available Block Transfer has the following items that are configurable:

- **Name**: Specifies the name to associate with the scheduled label
- **Type**: This is set to Acyclic for this type of transfer.

Buffer Details

A buffer is associated with each scheduled label to determine the data that is transmitted with the label. Within the buffer configuration, the depth, label, sdi, and data can be specified.

- **Depth**: Specifies the number of data combinations are associated with this label
- **Label**: The value of the label that is sent with the data, unless overwritten in the table
- **SDI**: The value of the SDI within the data field
- **Data**: Sets the value of the remaining data bits depending if parity is enabled and SDI is specified.

  Note: If the data field is longer than the remaining number of bits available, the

row will appear in red.

Depending on the values specified in configuration, the **Complete Word** section of the table will calculate and show the complete data word that will be transmitted.

The Buffer can be viewed in 4 of the following formats: Decimal, Hexadecimal, Octal, and Binary.

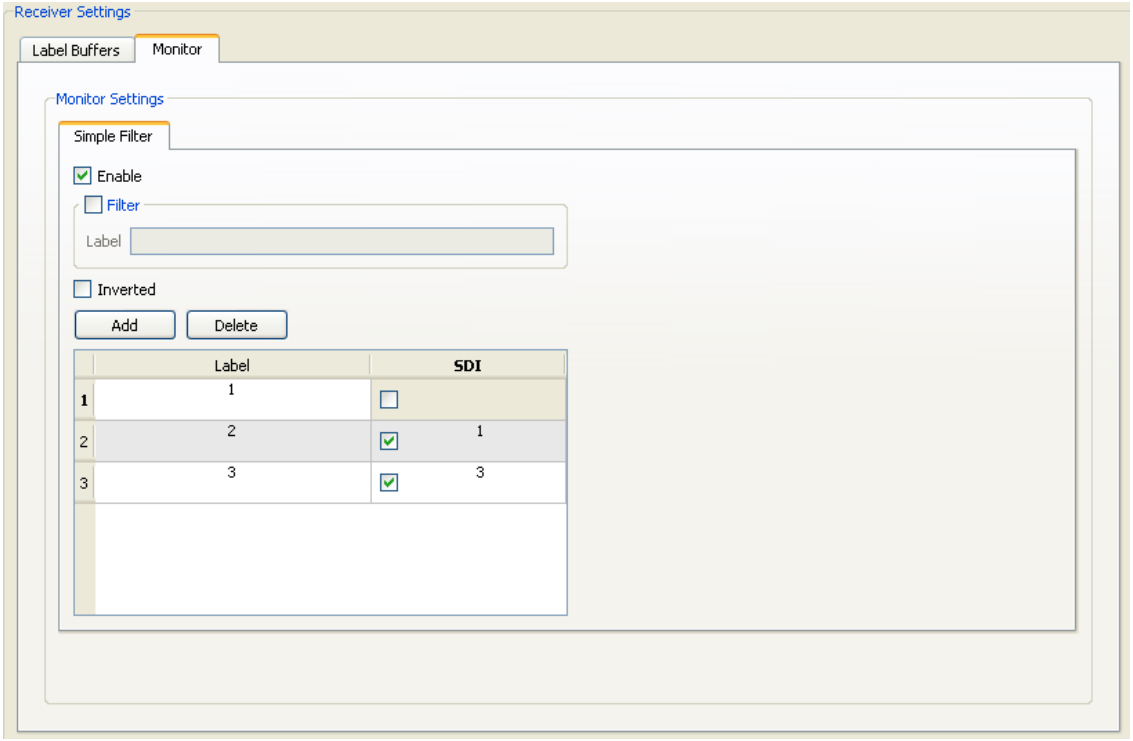
4.3.2 Receiver Settings

Configuration Options

This section describes the configuration options for ARINC-429 Receive Channels. In the *Settings* perspective, the selection of a Receiver node changes to the Receiver configuration context. There are 2 major configuration blocks related to the configuration at the Receiver level: Monitor and Label Buffers Settings. A Receive Channel can be setup to receive the label data in a chronological monitor on a per channel basis or label buffers can be configured for reception of label or label/sdi combinations.

Monitor Configuration

The monitor can be configured to receive all the data that has been transmitted or simple filters can be setup to capture only certain label data.



- To Enable the Simple Filter Click the **Enable** check box and then add the Label or

Label/SDI combinations.

- To Filter the table to only view the simple filters for a particular label, check the **Filter** box and specify the label

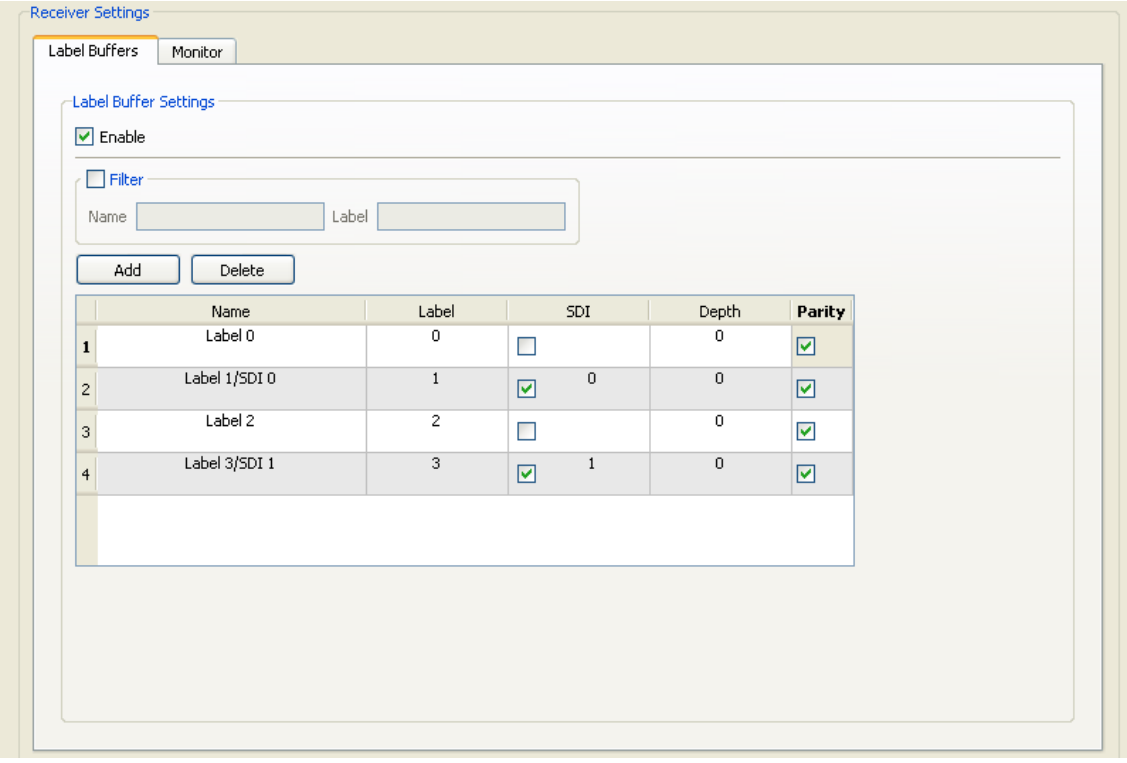
- To invert the filter select the **Inverted** Box. This will allow any labels set in the filter configuration to show up in the monitor, otherwise if this option is not selected any of the labels specified in the filter configuration will not appear in the monitor

- To Add or Delete filters, Click the **Add** or **Delete** buttons

    1. Once the Labels are added, specify the Label with the option of adding a SDI value to the filter.
       Note: If a filter is added with the same configuration twice, the row will appear in red

Label Buffer Configuration

Additionally, the Receive Channel can be configured with specific buffers for Label or Label/SDI combinations.



- To Enable the Label Buffer Click the **Enable** check box and then add the Label or Label/SDI combinations.

- To Filter the table to view a certain label buffer, check the **Filter** box and specify the name and/or label

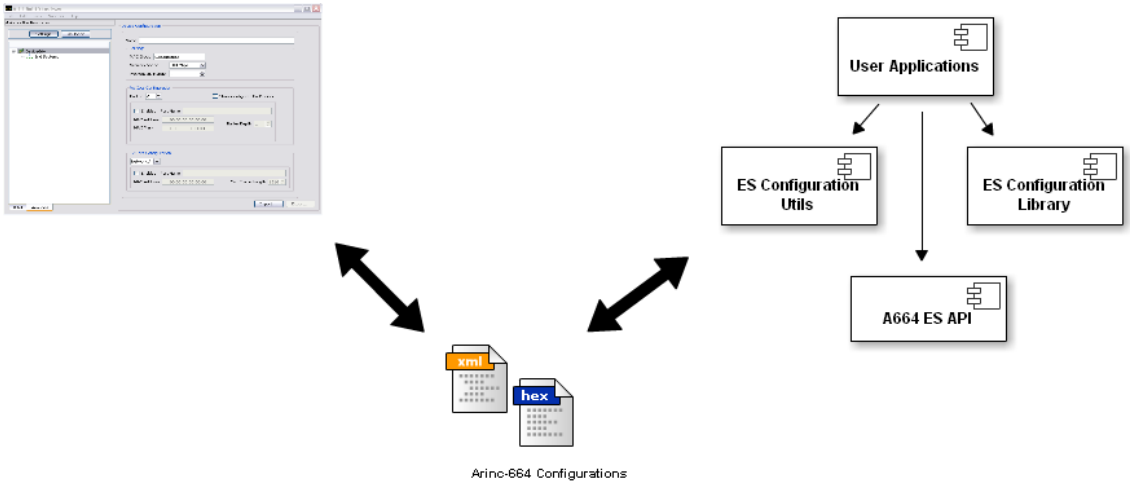
- To Add or Delete label buffers, Click the **Add** or **Delete** buttons

    1. Once the Labels are added, specify the Label with the option of adding a name, SDI value, buffer depth, and/or if parity is enabled.
    Notes:
    1) If a filter is added with the same configuration twice, the row will appear in red
    2) If parity is not enabled, then the 32 bit will be used as data.

5 ARINC-664

The *Flight Simulyzer* Analyzer Software can currently be used to create configurations for AIT's ARINC-664 hardware modules. An easy-to-use GUI allows complete visual programming that enables users to optimize, plan, and configure complete ARINC-664 End Systems.

Exported configurations are based on a common data format (XML) which can also be loaded from the AIT 664 ES Configuration Tools Library which in turn can be utilized to configure AIT 664 hardware programmatically.



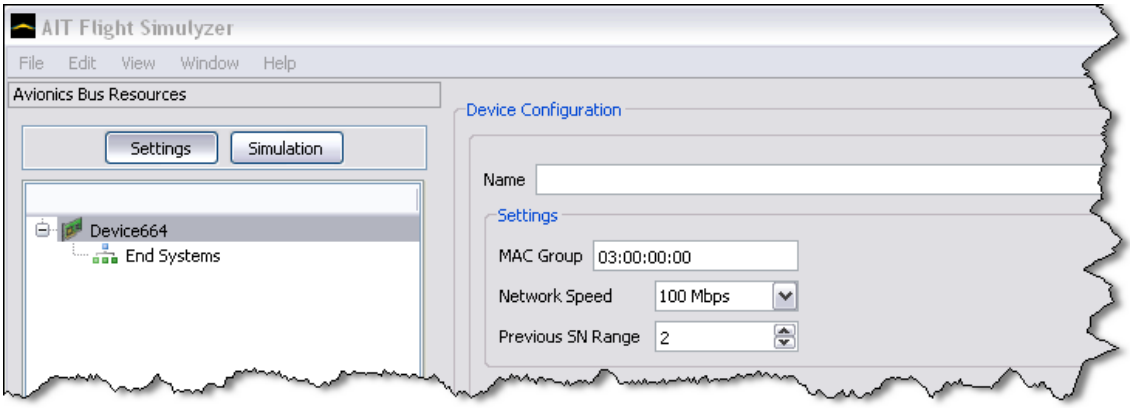
5.1 Features

- Visually configure Arinc664 Devices, End Systems, In/Out Vl's, and Communication Ports.
- Import and export configuration files for A664 Devices and End Systems.

5.2 Device

Configuration Options

This section describes the configuration options for Arinc664 Devices. In the *Settings* perspective, the selection of a Device node changes to the Device configuration context. There are 3 major configuration blocks related to the configuration at the Device level.



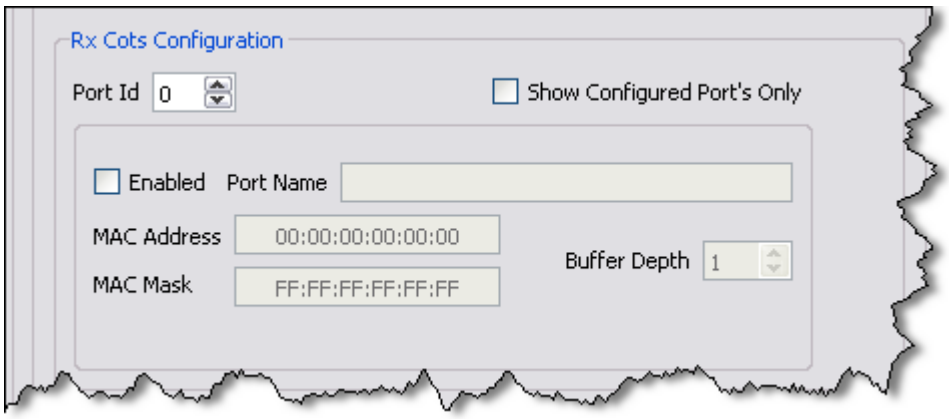
Basic Device Configuration Options

Basic Device Configuration Options:

Item	Description
Name	**The name to associate with the given Device**
Mac Group	**The constant field used in the first 4 bytes of MAC Destination addresses**
Network Speed	**The network interface speed**
Previous Sequence Number Range	**The range utilized by the Redundancy Management algorithm**

These options are global to all End Systems, Input/Output Vl's, and communication ports defined on this Device.

Rx Cots Configuration:

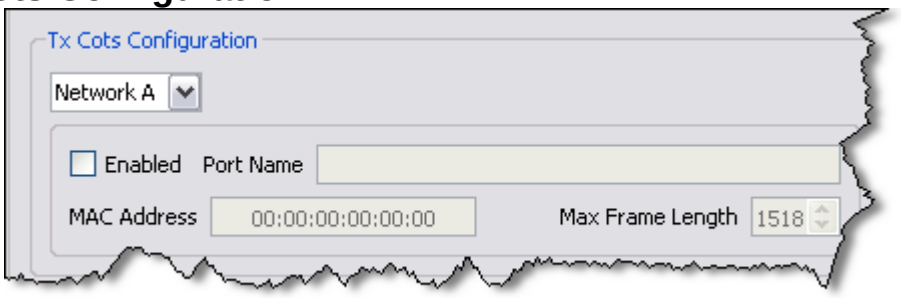


Rx Cots Configuration Settings

Item	Description
Port Id	Unique port identifier. Port Id values in the range 0, 31 are allowed
Show Configured Port's Only	Check this box to hide any unconfigured ports
Enabled	Enables/Disables the given port. Disabled ports serve no real purpose.
Name	The name to associate with the given port
Mac Address	The MAC address to associate with the port
Mac Address Mask	A mask to apply to the received frame before comparing Mac Addresses.
Buffer Depth	The number of messages that can be buffered at the port.

Up to 32 Rx Cots ports can be configured per Device. Cots ports are standard ethernet cut through ports, which can be utilized for generic ethernet traffic. The 'Show Configured Ports's Only' checkbox is a convenient way to view only the ports which have been previously configured. When checked, a drop down menu containing the configured port id's with their associated names is displayed. New ports cannot be configured when this option is selected.

Tx Cots Configuration:



Tx Cots Configuration Settings

Item	Description
Network Selection	**Select Network A or B for the given port configuration**
Enabled	**Enables/Disables the given port. Disabled ports serve no real purpose.**
Name	**The name to associate with the given port**
Mac Address	**The MAC address to associate with the port**
Max Frame Length	**The maximum allowed length of the Ethernet Frame**

Two Tx Cots ports can be configured per Device. Cots ports are standard ethernet cut through ports, which can be utilized for generic ethernet traffic.

Import/Export

Device configurations can be imported and exported to AIT's XML and hex formats. The *Export* button is disabled by default, unless the current configuration is valid for export. There are various reasons the Device configuration can be found to be invalid. Certain steps have been taken in the GUI to indicate when a configuration is invalid. The list below indicates the requirements for a valid Device configuration:

- If no End Systems are defined, at least one Tx or Rx Cots port must be enabled.
- If any End Systems are enabled, the following must be true:
  - At least one Vl must be enabled, with at least one underlying communications port enabled.
  - All enabled Vl's must have at least one enabled port.
  - OutputVl Id's must be unique among all OutputVl's on all End Systems on a Device.
  - All Tx Port Id's must be unique among all OutputVl's on all End Systems on a Device.
  - All Rx Port Id's must be unique among all InputVl's on all End Systems on a Device.

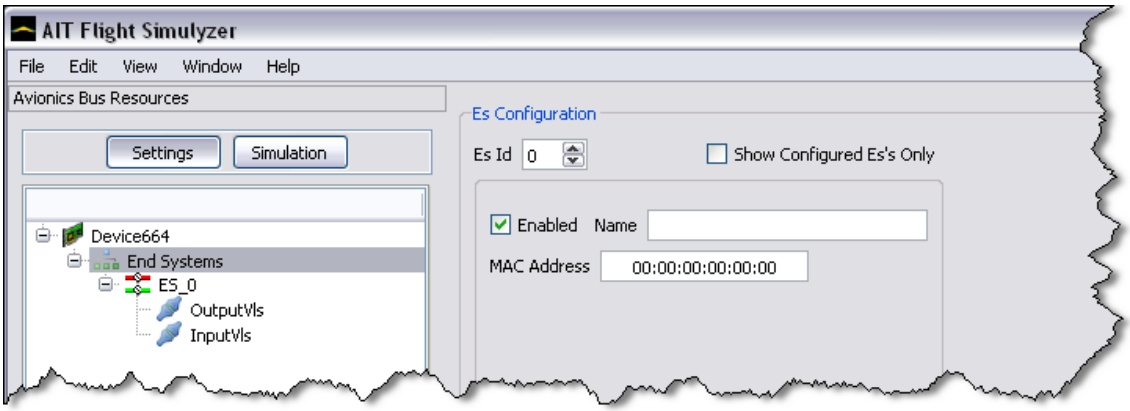
Ensuring the validity of the configuration is facilitated with the coloring of the Vl and Port Id selection widgets. When an Id conflict arises, the id selection widget is colored red and a tool tip is set indicating the cause of the conflict. If no conflicts exist, the *Export* button will be enabled.

NOTE: The Device Configuration context allows exporting to both XML and a hex format. The hex format is for use with the A664 ES API. Exporting a configuration to the hex format does not currently preserve the name field of any underlying configuration. If preserving the name is important, export the configuration to xml as well.

5.3 End System

Configuration Options

This section describes the configuration options for Arinc664 End Systems. In the *Settings* perspective, the selection of an End System node changes to the End System configuration context:



End System Configuration Options

Item	Description
Es Id	Unique End System identifier. Id values in the range 0, 31 are allowed
Show Configured Es's Only	Check this box to hide any unconfigured End Systems
Enabled	Enables/Disables the given End System. Disabled End Systems serve no real purpose.
Name	The name to associate with the given End System
Mac Address	The Source MAC address to associate with the End System

These options are global to all underlying Input/Output Vl's and the related communication ports. The 'Show Configured Es's Only' checkbox is a convenient way to view only the End Systems which have been previously configured. When checked, a drop down menu containing the configured End System id's with their associated names is displayed. New End Systems cannot be configured when this option is selected.

Import/Export

End System configurations can be imported and exported to AIT's XML format. The *Export* button is disabled by default, unless the current configuration is valid for export. There are various reasons the End System configuration can be found to be invalid. Certain steps have been taken in the GUI to indicate when a configuration is invalid. The list below indicates the requirements for a valid End System configuration:

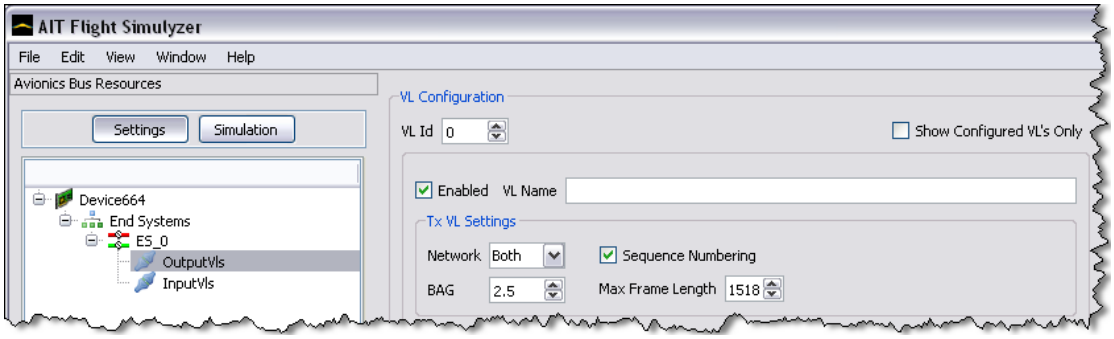
- For any End System, the following must be true:
  - At least one Vl must be enabled, with at least one underlying communications port enabled.
  - All enabled Vl's must have at least one enabled port.

5.4 Vl and Port Configuration

Configuration Options

This section describes the configuration options for Arinc664 Input and Output Vl's and their underlying communications ports. In the *Settings* perspective, the selection of either an Input or Output Vl node changes to the Vl and Port configuration context:

OutputVl Configuration

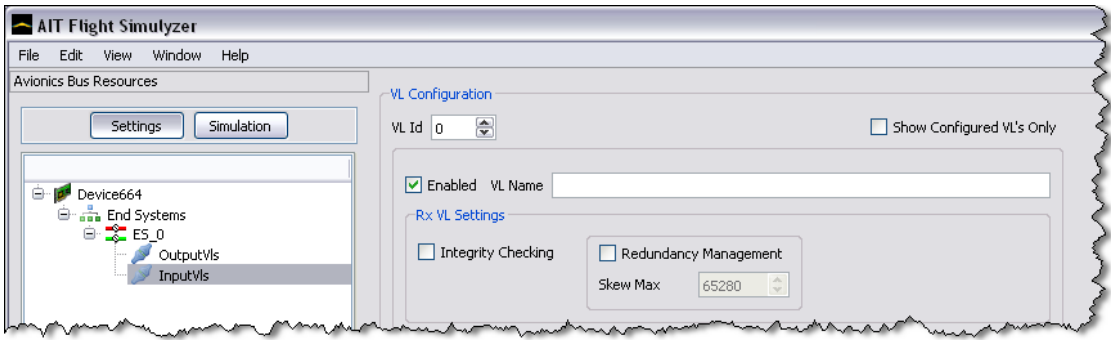


Tx Vl Configuration Settings

Item	Description
Vl Id	Unique Output Vl identifier. Id values in the range 0, 65535 are allowed
Show Configured Vl's Only	Check this box to hide any unconfigured Vl's
Enabled	Enables/Disables the given Vl. Disabled Vl's serve no real purpose.
VL Name	The name to associate with the given Vl
Network	The transmission network
Bag	The Bandwidth Allocation Gap
Sequence Numbering	Indicates if the Vl sequence number should be added to frames of this Vl
Max Frame Length	The maximum frame length in bytes supported by this Vl

The 'Show Configured Vl's Only' checkbox is a convenient way to view only the Output Vl's which have been previously configured on the current End System. When checked, a drop down menu containing the configured Vl id's with their associated names is displayed. New Vl's cannot be configured when this option is selected.

InputVl Configuration



Rx Vl Configuration Settings

Item	Description
Vl Id	**Vl identifier. Id values in the range 0, 65535 are allowed**
Show Configured Vl's Only	**Check this box to hide any unconfigured Vl's**
Enabled	**Enables/Disables the given Vl. Disabled Vl's serve no real purpose.**
Name	**The name to associate with the given Vl**
Integrity Checking	**Indicates if Vl Integrity Checking is enabled (This option is forced True if RM is enabled**
Redundancy Management	**Indicates if RM is enabled**
Skew Max	**The max skew allowed by RM**

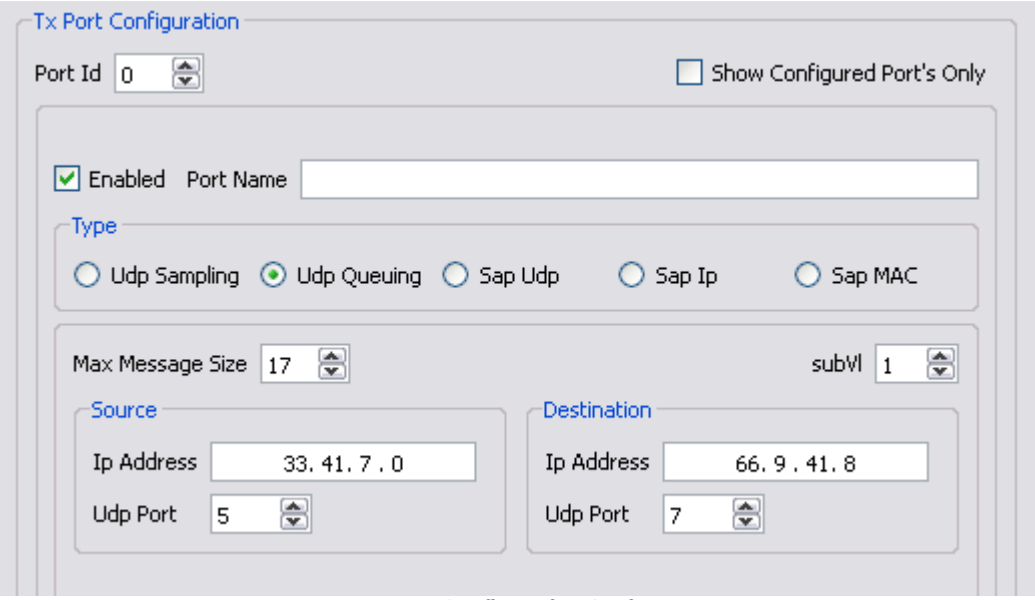
The 'Show Configured Vl's Only' checkbox is a convenient way to view only the Input Vl's which have been previously configured on the current End System. When checked, a drop down menu containing the configured Vl id's with their associated names is displayed. New Vl's cannot be configured when this option is selected.

Import/Export

Import and Export are not currently supported at the Vl level, however, the Vl configuration must be valid in order to export from the End System or Device contexts. Ensuring the validity of the configuration is facilitated with the coloring of the Vl Id selection widgets. When an Id conflict arises, the id selection widget is colored red and a tool tip is set indicating the cause of the conflict. Vl Id Conflicts are allowed if exporting a single End System but not when exporting at the Device level. Keep in mind, any Vl configuration is still invalid if enabled with no enabled underlying communications ports. This will prevent exporting at the End System level. See the Import/Export sections of the Device and End System Configuration pages for more information.

5.4.1 Port Configuration

Tx Communications Port

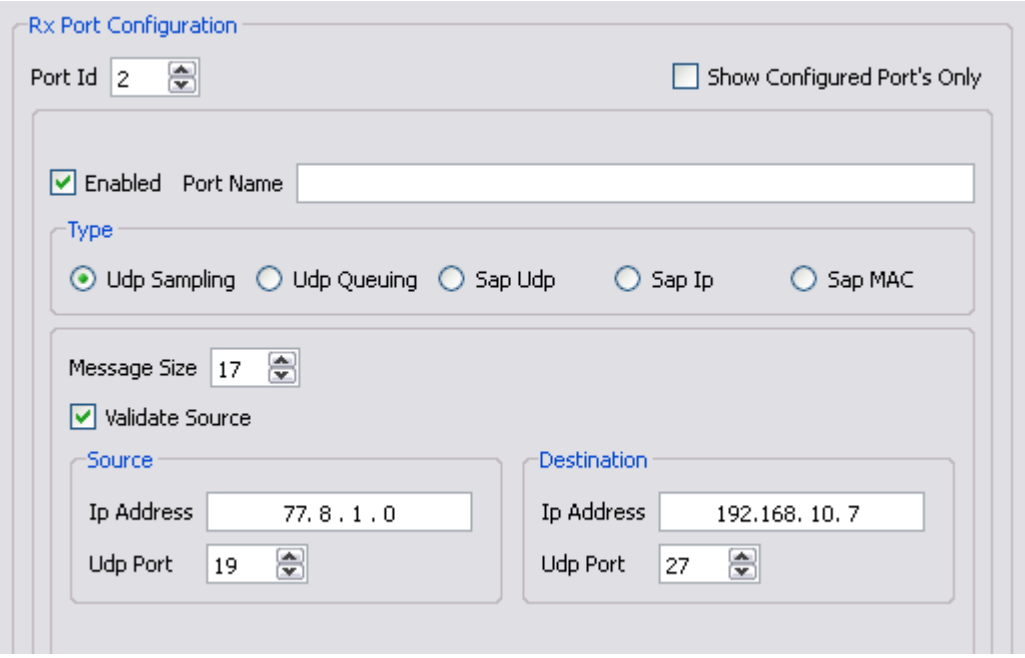


Tx Port Configuration Settings

Item	Description
Port Id	Unique Port identifier. Id values in the range 0, 1023 are allowed
Show Configured Ports Only	Check this box to hide any unconfigured ports
Enabled	Enables/Disables the given port. Disabled ports serve no real purpose.
Port Name	The name to associate with the given port
Type	The port type
subVl	The subVl to which the given port is associated

The 'Show Configured Ports Only' checkbox is a convenient way to view only the ports which have been previously configured on the current Vl. When checked, a drop down menu containing the configured port id's with their associated names is displayed. New ports cannot be configured when this option is selected. The other options not listed in the table are port type specific configuration options.

Rx Communications Port



Rx Port Configuration Settings

Item	Description
Port Id	Unique Port identifier. Id values in the range 0, 4095 are allowed
Show Configured Ports Only	Check this box to hide any unconfigured ports
Enabled	Enables/Disables the given port. Disabled ports serve no real purpose.
Port Name	The name to associate with the given port
Type	The port type

The 'Show Configured Ports Only' checkbox is a convenient way to view only the ports which have been previously configured on the current VI. When checked, a drop down menu containing the configured port id's with their associated names is displayed. New ports cannot be configured when this option is selected. The other options not listed in the table are port type specific configuration options.

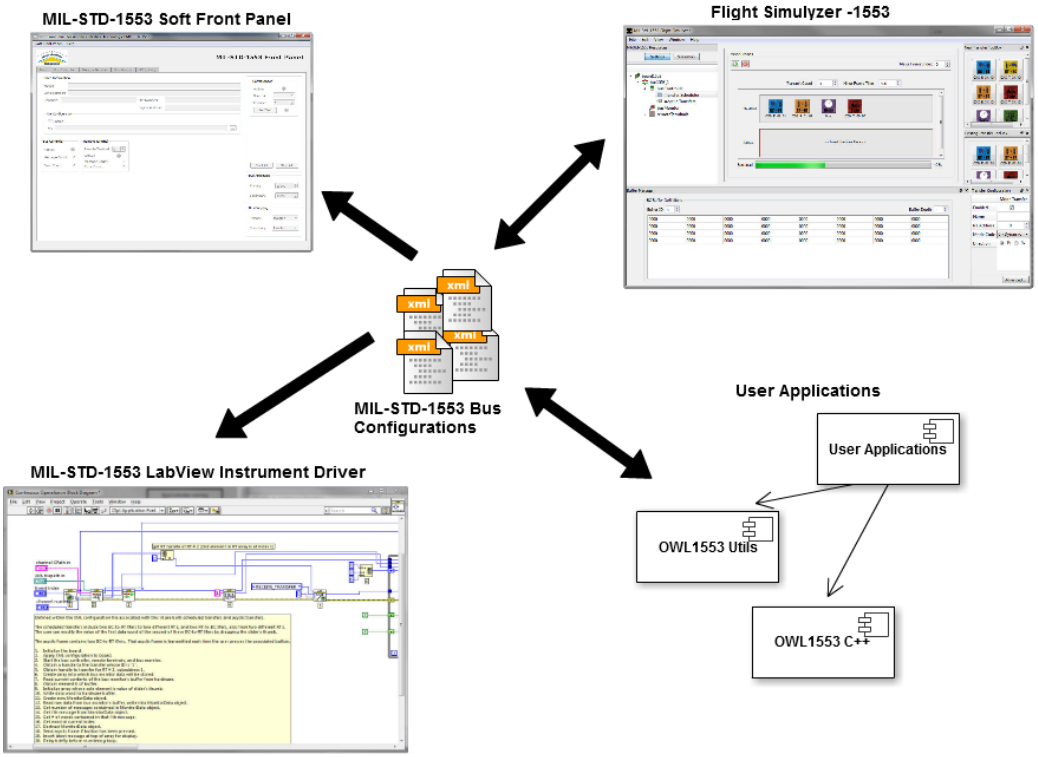
Import/Export

Import and Export are not currently supported at the port level, however, the port configuration must be valid in order to export from the End System or Device contexts. Ensuring the validity of the configuration is facilitated with the coloring of the port Id selection widgets. When an Id conflict arises, the id selection widget is colored red and a tool tip is set indicating the cause of the conflict. Port Id Conflicts are allowed if exporting a single End System but not when exporting at the Device level. See the Import/Export sections of the Device and End System Configuration pages for more information.

6 MIL-STD-1553

The *Flight Simulyzer* Analyzer Software can be used in conjunction with AIT's family of 1553 interface boards to provide a powerful Windows-based 1553 Analyzer tool. An easy-to-use GUI allows complete visual programming that enables users to troubleshoot, optimize, plan and configure MIL-STD-1553 databuses. Low-level and high-level protocol analysis features work by capturing, filtering, time stamping and interpreting MIL-STD-1553 databus traffic and then generating advanced statistics for the users.

Flight Simulyzer's BC, RT and BM configurations are based on a common data format (XML) which allows simulation setups created and used within the *Flight Simulyzer* application to also be loaded and executed from within the AIT MIL-STD-1553 LabView instrument driver, high-level C++ and C# application interface libraries, and the MIL-STD-1553 soft front panel application.



AIT MIL-STD-1553 Software Development Kit

6.1 Features

- Concurrent operation of multiple 1553 databuses and boards
- Time Correlation with Internal/External IRIG-B across Multiple 1553 databuses
- XML setup file for project, Bus Controller, Remote Terminal(s) and Bus Monitor setups
- Full access to 1553 databus memory associated with Bus Controller, Remote Terminal(s) and Bus Monitor
- Comprehensive Trigger and Filter capabilities (ie: on Bus Controller, on Remote Terminal and Bus Monitor data patterns within received data, errors, etc...)

6.1.1 Bus Controller Features

- Intuitive, easy-to-use user interface for defining major/minor framing schedules
- Full support for MIL-STD-1553 A/B mode code operations
- Full error injection, definable independently per BC command with full compliment of errors supported, including:
  - Command/Data word sync errors
  - Parity errors
  - Manchester encoding errors
  - Word/Bit count high/low errors
  - Gap time errors
  - Signal zero crossing errors
- Acyclic (on user command) data transfers
- View/Edit transfer buffers 'on-the fly'

6.1.2 Remote Terminal Features

- Fully configure Tx/Rx buffers for each subaddress and mode code
- Define hardware controlled handling of status responses, including response time in microseconds
- Define response bus (independent of bus command received from)
- Full error injection configurable per RT subaddress with full compliment of errors supported, including:
  - Status/Data word sync errors
  - Word/Bit count high/low errors
  - Responses on wrong bus
  - Manchester encoding errors
  - Zero crossing errors
  - Gap time and parity errors
- Independently view and modify RT subaddress data 'on-the-fly'

6.1.3 Bus Monitoring Features

- Simple and/or complex start, stop, and strobe triggers
- Data filtering based on RT and subaddresses
- Illegal RT subaddress/mode code combinations to be flagged as errors by the BM
- Status word conditions to be flagged as errors by the BM

6.1.4 Replay Features

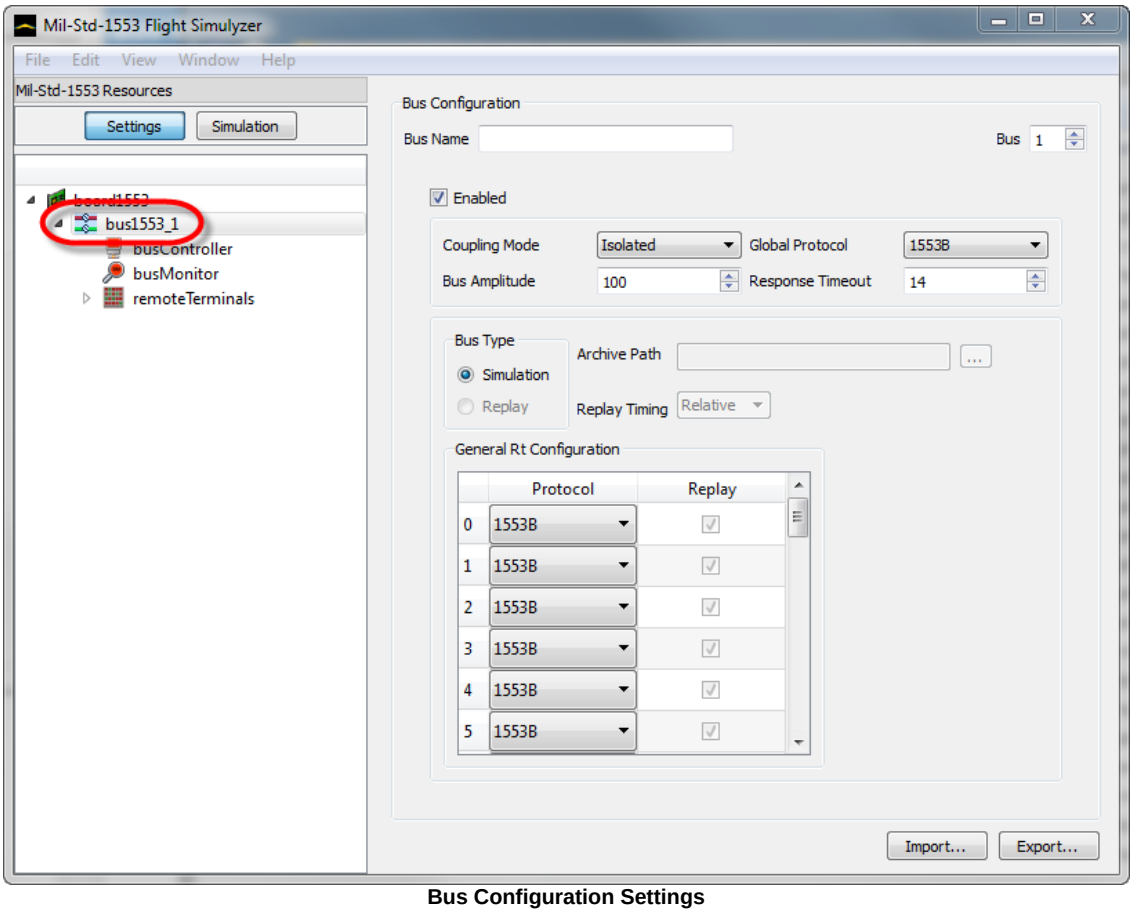
- Reconstruct 1553 databus traffic from recorded files in real-time
- Filter-specific Remote Terminal response from recorded file during reconstruction

6.2 Bus Configuration

This section describes the MIL-STD-1553 Bus Configuration options available in the GUI.

6.2.1 Bus Settings

The MIL-STD-1553 Bus Interface configuration can be accessed by selecting a Bus (Channel) from the resource window.



Bus Configuration Settings

Each available MIL-STD-1553 Bus Interface of the hardware device can be individually configured. The following items are configurable:

- **Coupling Mode**: Specifies the electrical coupling mode used by the bus interface of the hardware devices. The available coupling modes are dependant on the MIL-STD-1553 hardware module.

Coupling Mode	Description
Isolated	The MIL-STD-1553 Bus interface of the hardware module is isolated from the front panel connector of the device. That is, it is isolated from the externally connected bus
Transformer	MIL-STD-1553 Transformer mode coupling
Direct	MIL-STD-1553 Direct mode coupling
External	The MIL-STD-1553 hardware device bus interface provides onboard emulation of a MIL-STD-1553 bus and an equivalent bus stub is provided at the front panel of the hardware device. This mode allows a transformer coupled device to be directly connected (without an external bus coupler) to the MIL-

	STD-1553 bus interface of the AIT device.
Loopback	The Digital Loopback mode provides an internal (onboard) loopback of the MIL-STD-1553 signal.
Fixed	The MIL-STD-1553 hardware device's bus interface is connected to the front panel connector of the device. The actual coupling mode is dependant on the mode(s) supported by the hardware device (i.e. Transformer or Direct)

- **Global Protocol**: Specifies whether the MIL-STD-1553A or MIL-STD-1553B protocol is used for the bus interface.
- **Bus Amplitude**: Specifies the voltage amplitude of the output bus signal of the MIL-STD-1553 device. Amplitude is specified as a percentage. The actual voltage is dependant on the specifications of the MIL-STD-1553 device. Only AIT Extended Function devices (PXI-C1553-EF, PCI-C1553-EF, PCIe-C1553-EF, and VXI-C1553T) support configurable bus amplitude.
- **Response Timeout**: Specifies the Remote Terminal response timeout in microseconds. This is the maximum time for an RT to resond to BC commands on this bus. If an RT does not respond to commands within this time, a *No Response* error is assumed (and reported by the BC and BM).

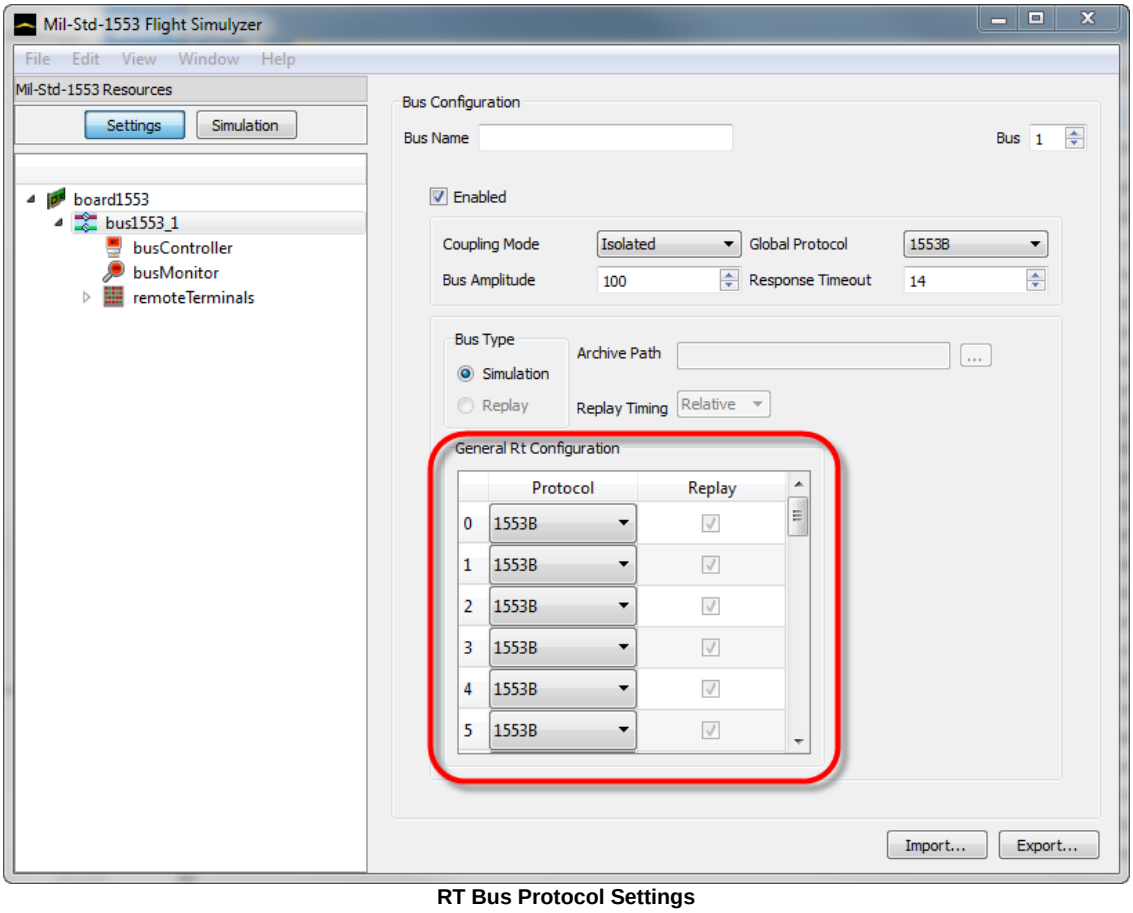
The operational mode of the MIL-STD-1553 Bus Interface can be selected in the bus settings.

- **Simulation**: This mode allows the configuration and simulation of the BC, RT(s), and the BM
- **Replay**: This mode allows a previously captured (by the BM) bus recording to be replayed on the bus interface

For each Remote Terminal of the bus interface, the MIL-STD-1553 protocol variant (1553A or 1553B) can be configured in the **General Rt Configuration** area. This setting dictates how the BC handles commands/responses for the RT and also how the BM interprets responses from the RT.

6.2.2 Bus RT Protocol

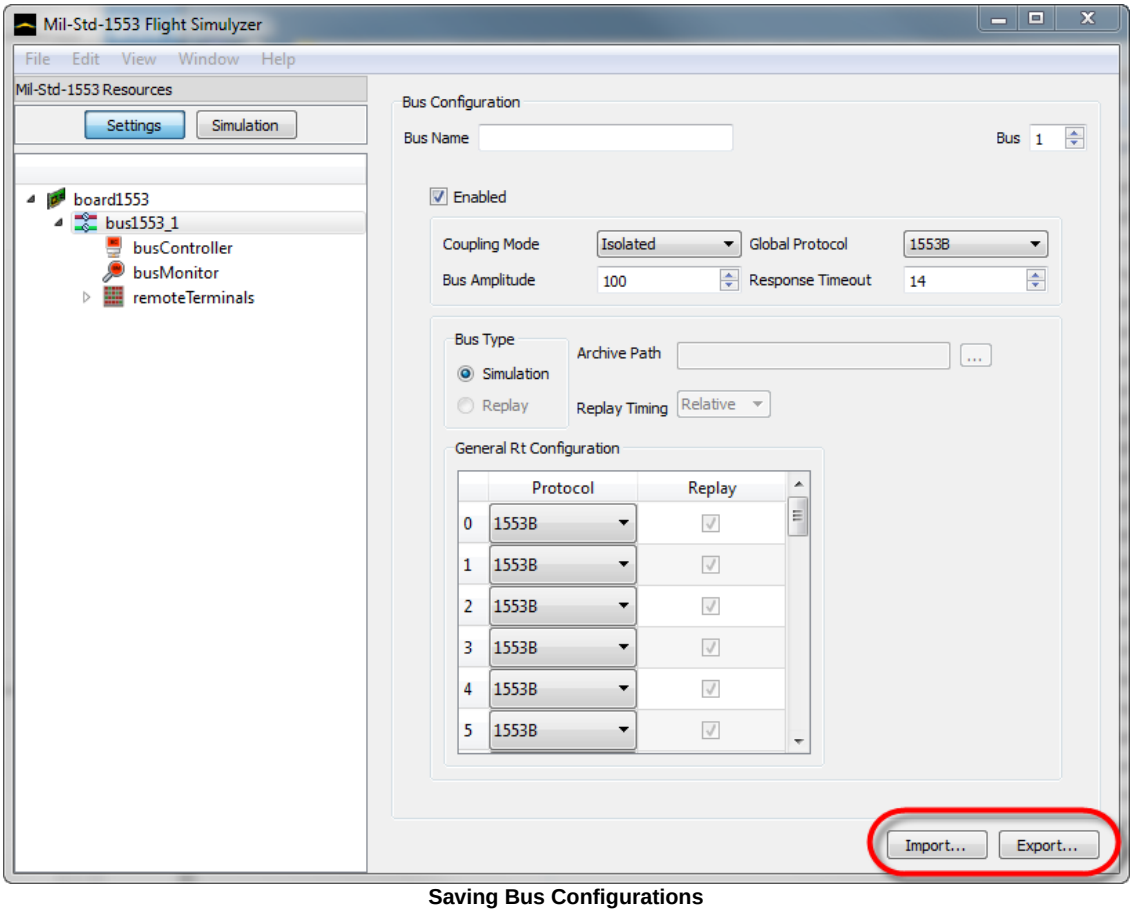
For each Remote Terminal of the bus interface, the MIL-STD-1553 protocol variant (1553A or 1553B) can be configured in the **General Rt Configuration** area. This setting dictates how the BC handles commands/responses for the RT and also how the BM interprets responses from the RT.



RT Bus Protocol Settings

6.2.3 Saving Bus Setup Information

The Bus setup information can be saved as an xml file, or alternatively as a binConfig file. If you highlight the Bus Interface node in the resource tree, import and export buttons appear in the lower right hand corner.



Saving Bus Configurations

Clicking the **Export** button will enable you to save the setup configuration of the Bus interface. The Bus Interface setup configuration includes the setup configuration information of all components, including the BC, RT(s), and BM setup configurations. If the XML file format is used, the xml file can be edited using any xml browser/editor. The binConfig file format should be used when exporting if it will be used in a LabVIEW Real-Time target.

The **Import** button enables you to import the Bus setup information.

6.3 Bus Controller

The main function of the Bus Controller (BC) is to provide data flow control for all transfers on the 1553 databus.

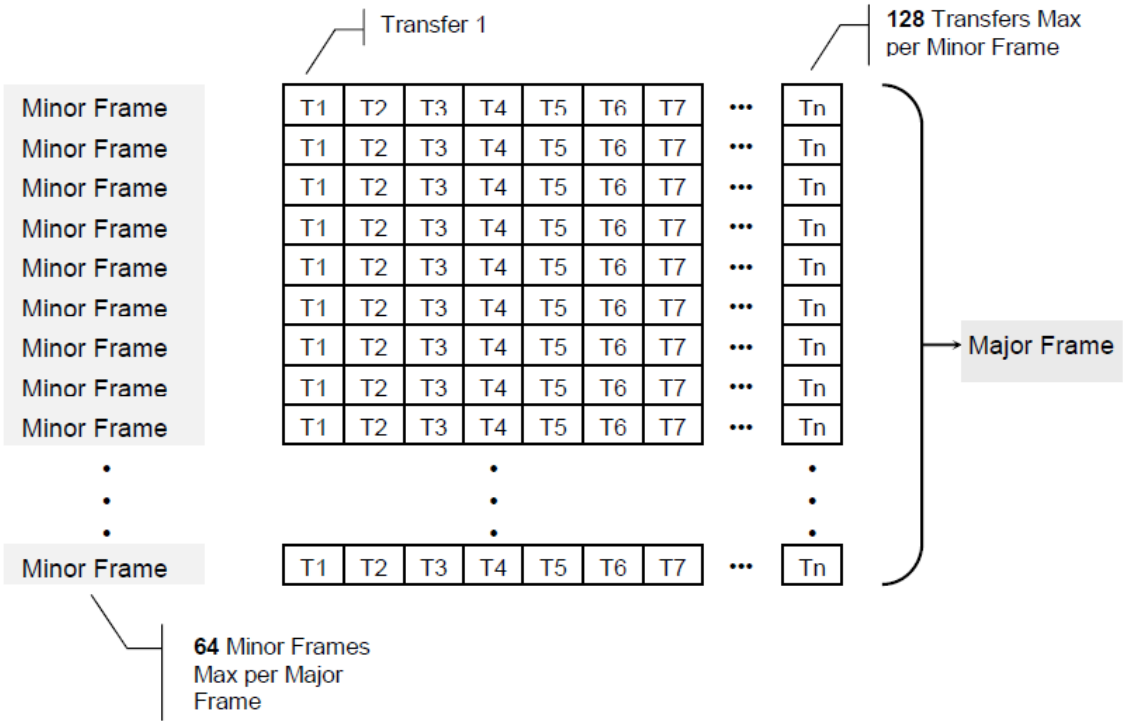
The BC must initiate and coordinate the transfer of information on the data bus. All information is communicated in command/response mode. The BC sends a command to the RTs, which reply with a response.

Setting up the BC involves defining individual 1553 transfers. These defined transfers are then grouped together to create Minor Frames. From this group of Minor Frames,

Major Frames are constructed.

Multiple Transfers make up a Minor Frame, and any Transfer can be used multiple times. One or more Minor Frames make up a Major Frame.

Figure 5 - Frame Topology

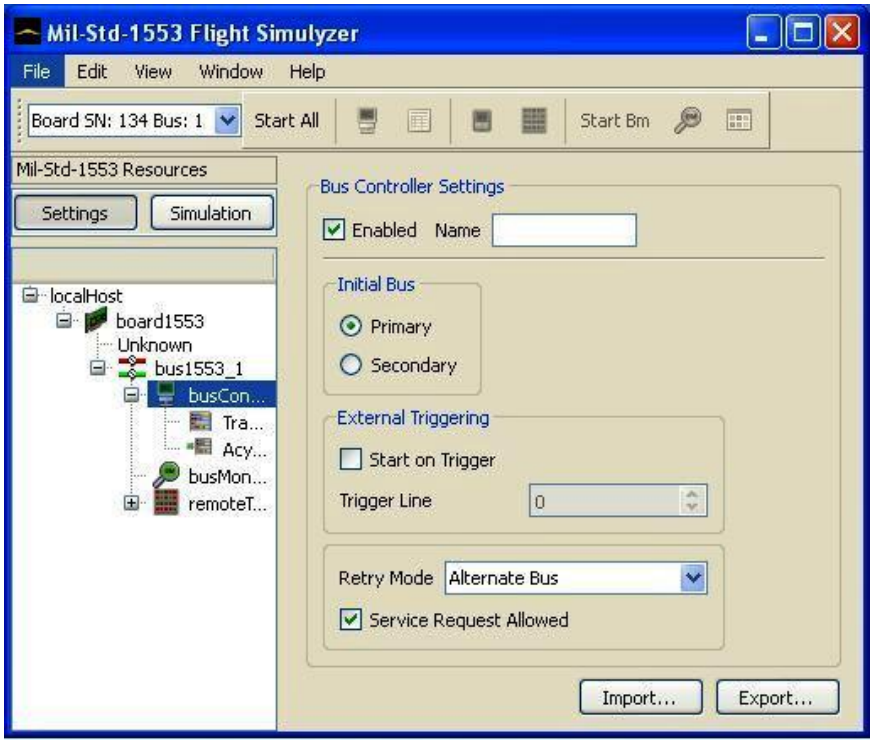


6.3.1 BC Transfer Scheduling

- To set up BC Transfers:

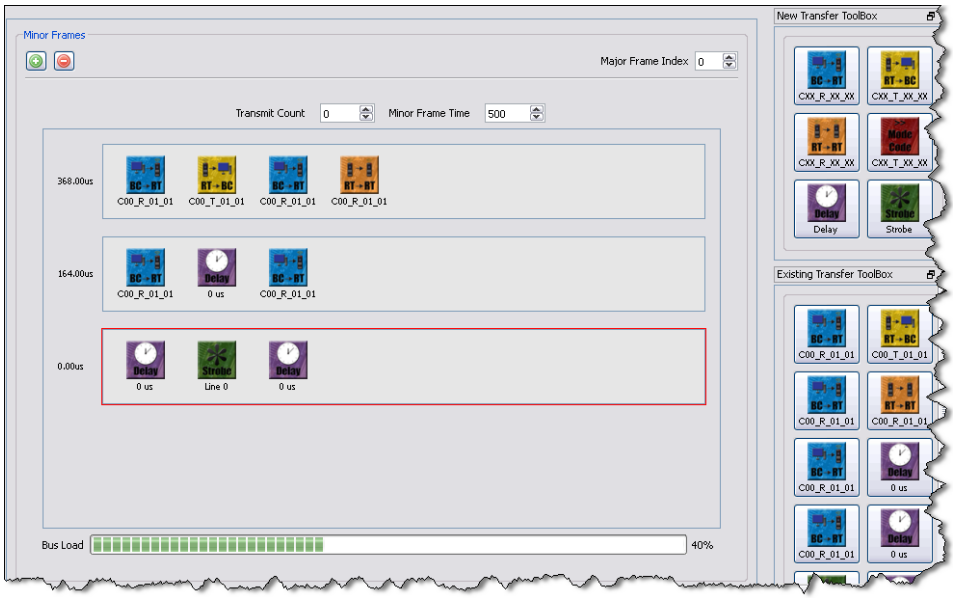
    1. Select the **Settings** button from the main screen and highlight **busController** node in the resource tree. Make sure the Bus Controller is enabled by checking the box next to **Enabled**, as seen below.

Bus Controller Settings menu


Mil-Std-1553 Flight Simulyzer
File
Edit
View
Window
Help
Board SN: 134 Bus: 1
Start All
Start Bm
Mil-Std-1553 Resources
Settings
Simulation
localHost
board1553
Unknown
bus1553_1
busCon...
Tra...
Acy...
busMon...
remoteT...
Bus Controller Settings
Enabled
Name
Initial Bus
Primary
Secondary
External Triggering
Start on Trigger
Trigger Line
0
Retry Mode
Alternate Bus
Service Request Allowed
Import...
Export...

2. Next, highlight the **Transfer Scheduler**. The BC transfer scheduler window (shown below) will appear and you can start constructing your schedule. Minor frames are represented by boxes that allow drag and drop of transfers from the New or Existing Transfer Toolbox. Transfers are sent sequentially as shown in the diagram below from left to right. One or more minor frames make up a major frame. Minor frames are transmitted sequentially as shown in the display from top to bottom. Only one major frame can be active at any given time on a Bus Controller.

BC Transfer Scheduler



3. To add Minor Frames to the schedule:

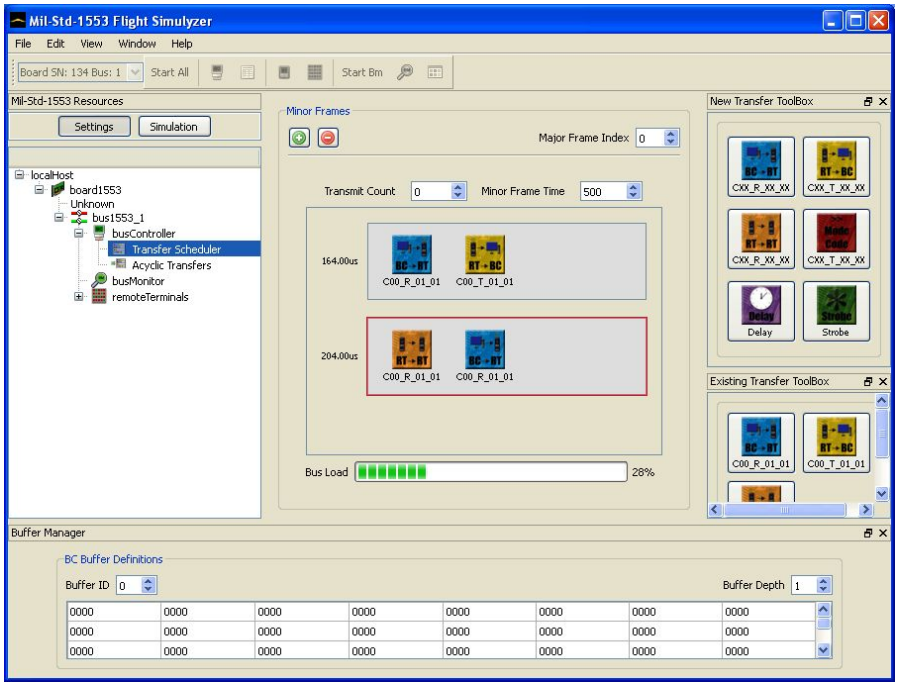
- In the **Bus Controller Scheduler** window locate the **Minor Frames** buttons:

- Use these buttons to add or delete Minor Frames.

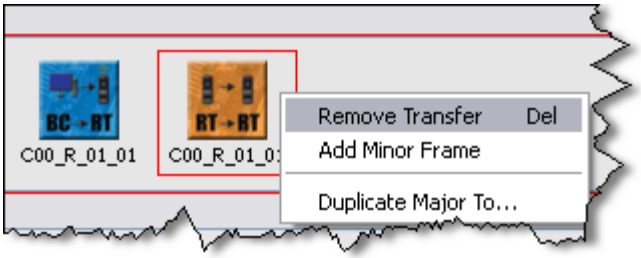
When you add another Minor Frame an additional frame appears as an additional rectangle in the Frame Scheduler window. You can highlight any

Minor Frame to work on the transfers contained within it. The selected Minor Frame will have a red rectangle around it. Minor frames can be moved (via drag and drop), copied (control + click), duplicated to another Major frame via right click, or deleted (via right click).

The transmit count value refers to how many times all of the Minor Frames contained in the Major frame will be sent. A value of "0" means send the same Major Frame continuously.



4. Transfers are added to minor frames and can be moved within minor frames and between minor frames via drag and drop. Control + clicking a transfer allows copying within and between minor frames. Deleting transfers can be done via right click or the Del key.



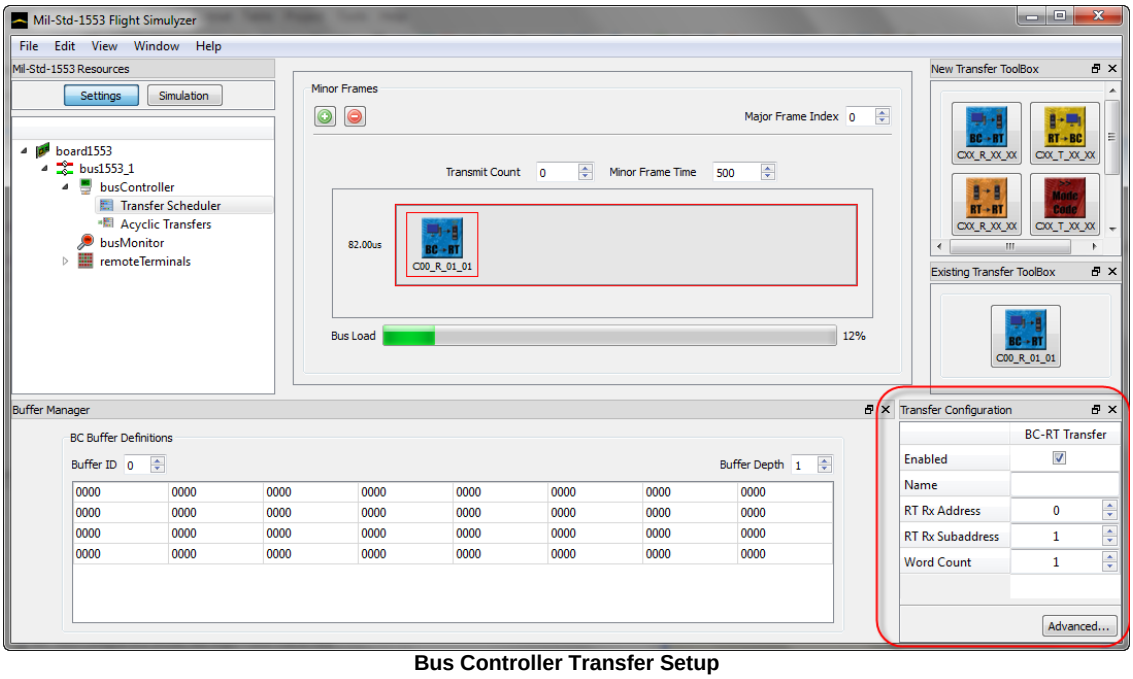
6.3.1.1 Creating BC to RT Transfers

- To set up a BC to RT Transfer:

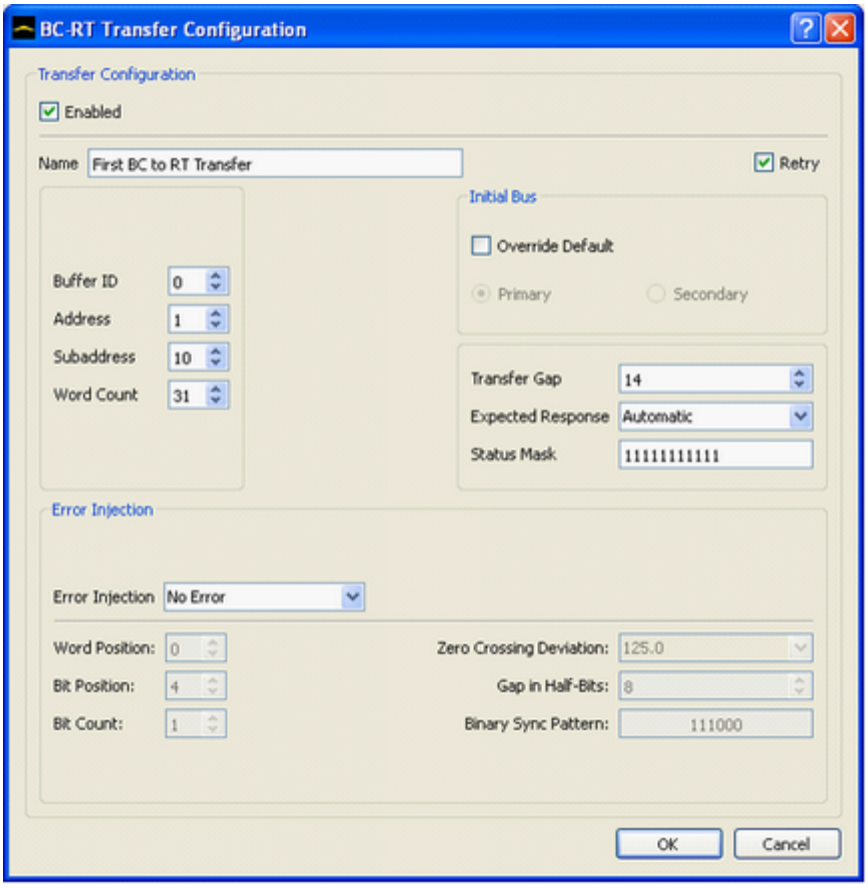
1. Click on the blue **BC – RT icon** and drag it from the **New Transfer** toolbox into a **Minor Frame**.

BC-RT Transfer Icon

2. Select the **BC – RT icon** in the Minor Frame box and then enter the transfer data in the **Transfer Configuration** area. Advanced Transfer Configuration details (i.e. Error Injection) may be entered by selecting the **Advanced...** button of **Transfer Configuration** area.



Bus Controller Transfer Setup



BC Transfer Details

For BC - RT Transfers, the following items may be configured:

- Name: user-defined name associated with this transfer
- Buffer ID: ID number of the data buffer associated with this transfer (Note: data inserted in this buffer can be defined in the previous menu)
- Address: RT address
- Subaddress: RT subaddress
- Word Count: number of data words associated with this transfer
- Retry check box: whether this transfer should be tried again if an error occurs
- Override Default: check box to indicate if the transfer should be sent over primary or secondary channel based on default configuration setup
- Transfer Gap: the time from the start of this message to the next (in milliseconds)
- Expected Response: the expected response from the RT, choices are automatic and 2 user-defined status words
- Status Mask: the status word exception mask bits (1 = accept, 0 = disregard)
- Error Injection: this section is used to turn on specific 1553 protocol and waveform errors associated with the transfer

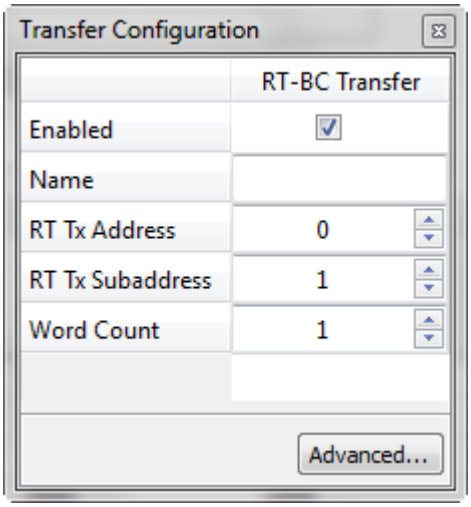
6.3.1.2 Creating RT to BC Transfers

- To set up an RT to BC Transfer:

1. Click on the yellow **RT – BC icon** and drag it from the **New Transfer** toolbox into a **Minor Frame**.

RT - BC Icon

2. Select the **RT – BC icon** in the Minor Frame box and then enter the transfer data in the **Transfer Configuration** area. As with the BC - RT transfers, advanced configurations (including error injection) are possible by selecting the Advanced... button of the **Transfer Configuration** area.



6.3.1.3 Creating RT to RT Transfers

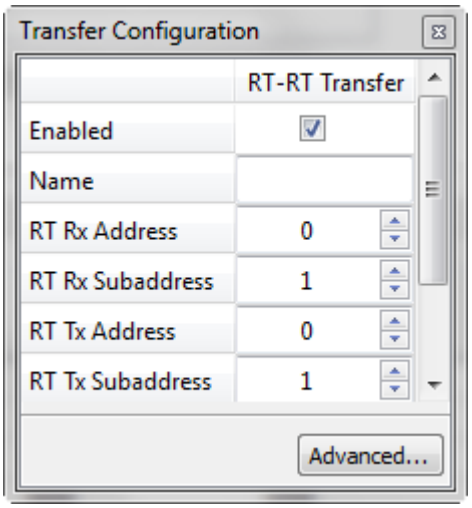
- To set up an RT to RT Transfer:

1. Click on the orange **RT to RT icon** and drag it from the **New Transfer** toolbox into a **Minor Frame**.

RT - RT Icon

2. Select the **RT – RT icon** in the Minor Frame box and then enter the transfer data in the **Transfer Configuration** area. As with the BC - RT transfers, advanced configurations (including error injection) are possible by selecting the **Advanced...** button of the **Transfer**

Configuration area.



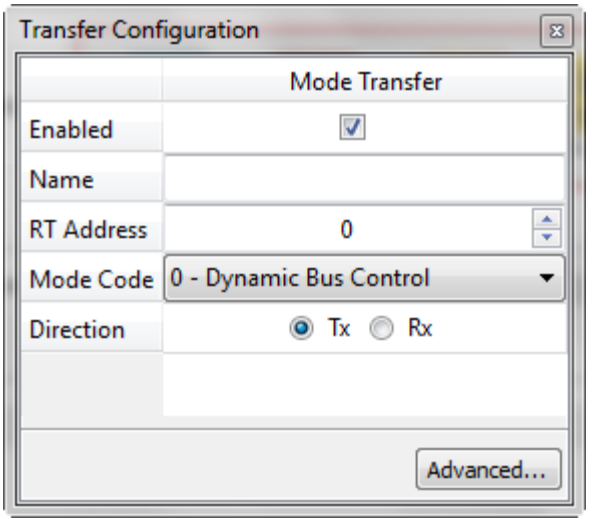
6.3.1.4 Creating Mode Code Transfers

- To set up a Mode Code Transfer:

1. Click on the red **Mode Code icon** and drag it from the **New Tr**ansfer toolbox into a **Minor Frame**.

Mode Code Transfer Icon

2. Select the **Mode Code icon** in the Minor Frame box and then enter the transfer data in the **Transfer Configuration** area. As with the BC - RT transfers, advanced configurations (including error injection) are possible by selecting the **Advanced...** button of the **Transfer Configuration** area.



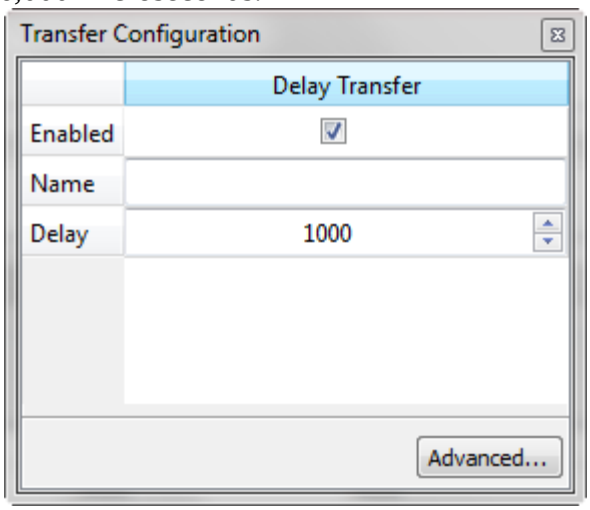
6.3.1.5 Add a Delay to the Schedule

- To add a Delay to the Schedule:

1. Click on the purple **Delay** icon and drag it from the **New Transfer** toolbox into a **Minor Frame**.

Delay Icon

2. Select the **Delay** icon in the Minor Frame box to setup a delay within the Minor Frame within the **Transfer Configuration** area. The Delay can be set up to 16,000 microseconds.



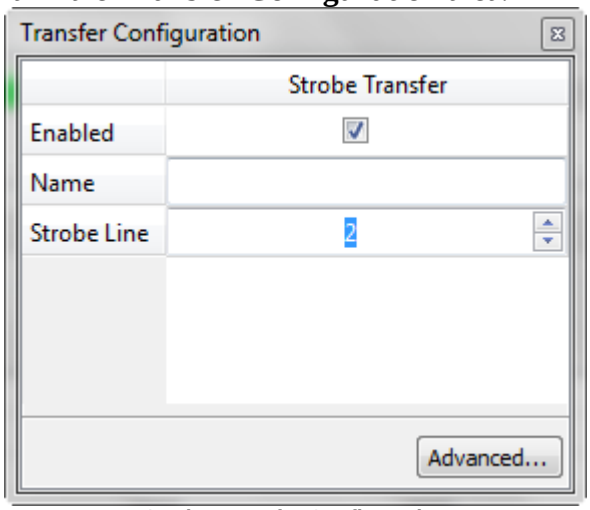
6.3.1.6 Using Strobe Transfers

- To set up a Strobe Transfer:

1. Click on the green **Strobe** icon and drag it from the **New Transfer** toolbox into a **Minor Frame**.

Strobe Icon

2. Select the **Strobe** icon in the Minor Frame box to setup an output strobe line within the **Transfer Configuration** area.

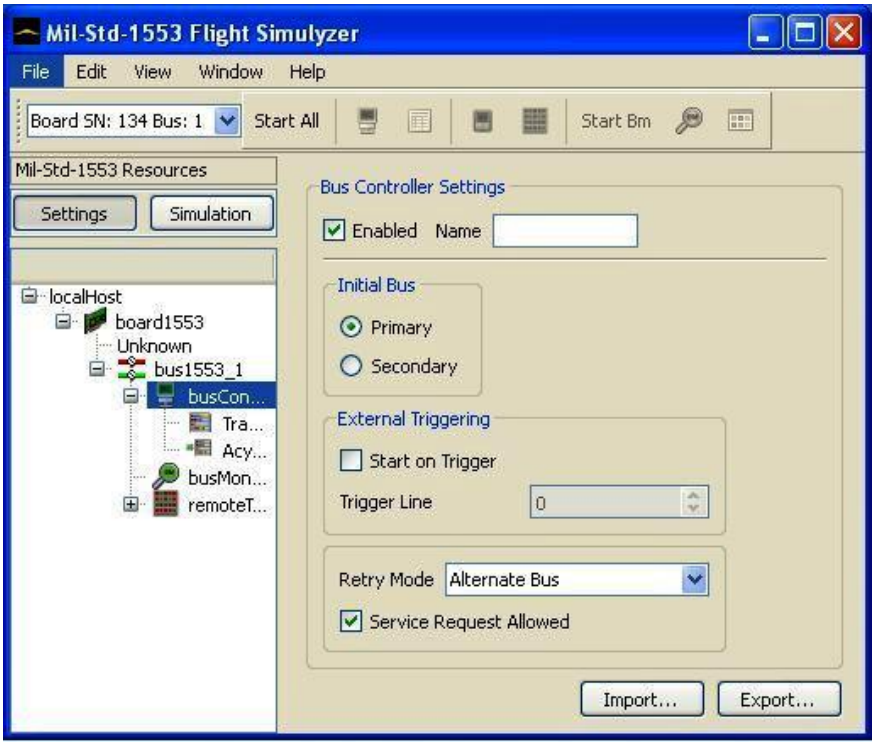


Strobe Transfer Configuration

6.3.2 Saving Bus Controller Setup Information

The Bus Control setup information can be saved as an xml file, or alternatively as a binConfig file. If you highlight the **busController** in the resource window, import and export buttons appear in the lower right hand corner.

Figure 5.3 - Bus Controller Settings



Clicking the **Export** button will enable you to save the setup configuration of the Bus Controller. If the XML file format is used, the xml file can be edited using any xml browser/editor. The binConfig file format should be used when exporting if it will be used in a LabVIEW Real-Time target.

The **Import** button enables you to import the Bus Controller setup information.

6.3.3 Starting the Bus Controller

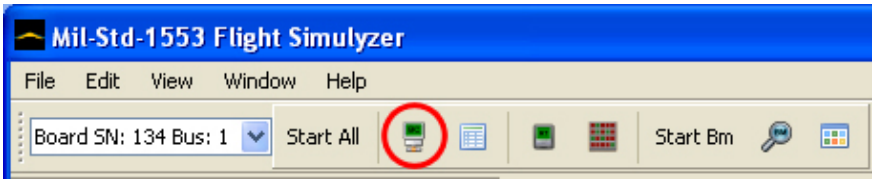
- To start the Bus Controller:

1. Press the **Simulation** button. The 1553 resources screen enables you to start the Bus Controller by doing one of the following:

   - Right click on **busController** in the resource pane, and choose **Start BC**.

   - Click on the **Bus Controller** icon in the Menu Bar, shown in the red circle below.

Figure 5.4 - Bus Controller Icon

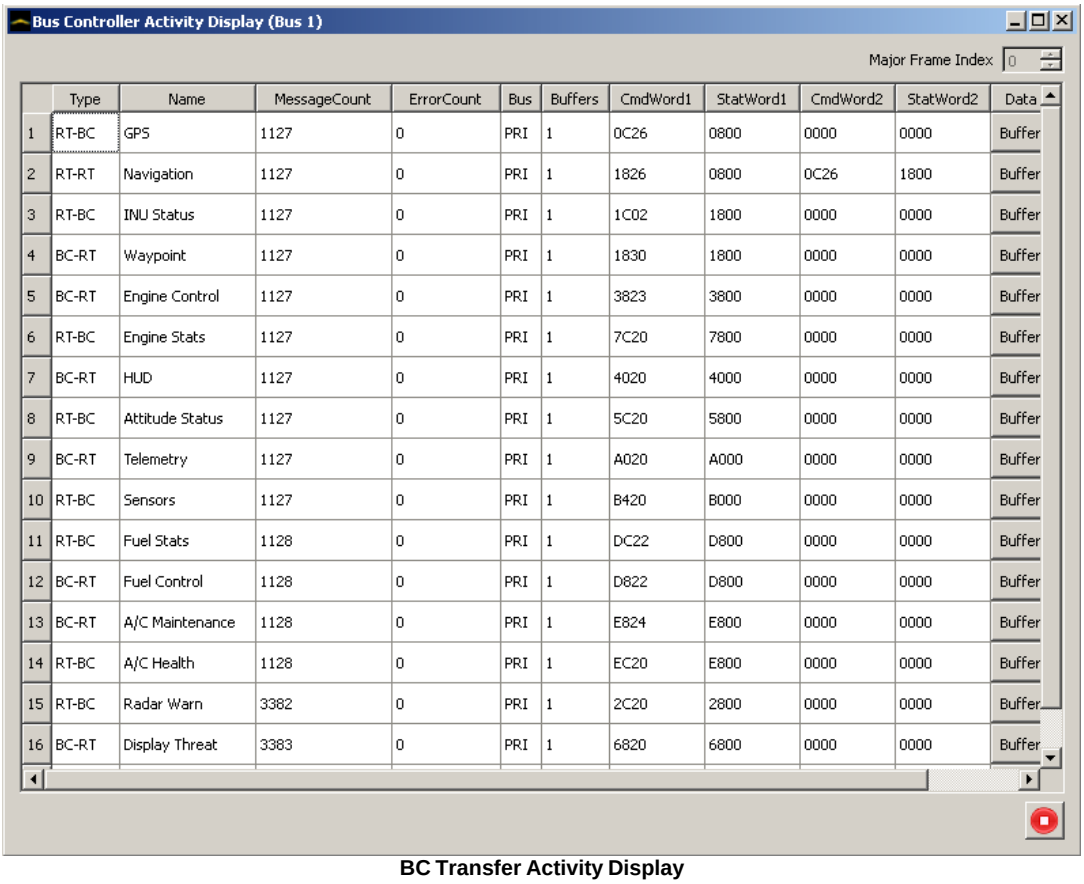


Note: The Start All button enables you to start the BC, Remote Terminals, and Bus Monitor using a single button.

6.3.4 Operating the Bus Controller

After the BC has been started, it is possible to view the status of the BC Transfers of the currently active Major Frame.

- To view the active BC Transfers
  1. Right click over the busController icon in the resource tree.
  2. This will open the BC Activity Display which is shown below.



	Type	Name	MessageCount	ErrorCount	Bus	Buffers	CmdWord1	StatWord1	CmdWord2	StatWord2	Data
1	RT-BC	GPS	1127	0	PRI	1	0C26	0800	0000	0000	Buffer
2	RT-RT	Navigation	1127	0	PRI	1	1826	0800	0C26	1800	Buffer
3	RT-BC	INU Status	1127	0	PRI	1	1C02	1800	0000	0000	Buffer
4	BC-RT	Waypoint	1127	0	PRI	1	1830	1800	0000	0000	Buffer
5	BC-RT	Engine Control	1127	0	PRI	1	3823	3800	0000	0000	Buffer
6	RT-BC	Engine Stats	1127	0	PRI	1	7C20	7800	0000	0000	Buffer
7	BC-RT	HUD	1127	0	PRI	1	4020	4000	0000	0000	Buffer
8	RT-BC	Attitude Status	1127	0	PRI	1	5C20	5800	0000	0000	Buffer
9	BC-RT	Telemetry	1127	0	PRI	1	A020	A000	0000	0000	Buffer
10	RT-BC	Sensors	1127	0	PRI	1	B420	B000	0000	0000	Buffer
11	RT-BC	Fuel Stats	1128	0	PRI	1	DC22	D800	0000	0000	Buffer
12	BC-RT	Fuel Control	1128	0	PRI	1	D822	D800	0000	0000	Buffer
13	BC-RT	A/C Maintenance	1128	0	PRI	1	E824	E800	0000	0000	Buffer
14	RT-BC	A/C Health	1128	0	PRI	1	EC20	E800	0000	0000	Buffer
15	RT-BC	Radar Warn	3382	0	PRI	1	2C20	2800	0000	0000	Buffer
16	BC-RT	Display Threat	3383	0	PRI	1	6820	6800	0000	0000	Buffer

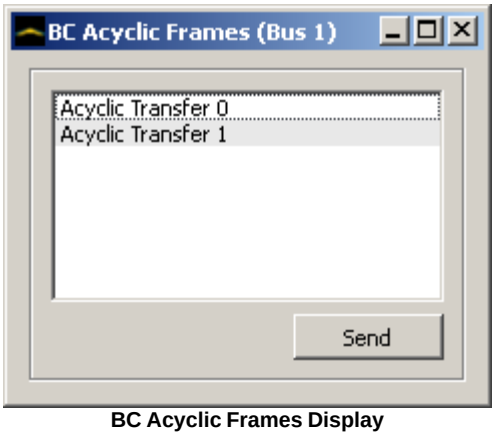
BC Transfer Activity Display

Several BC Operations are possible from inside the BC Activity Display window:

1. The BC can be started and stopped using the button at the lower right corner of the window.
2. The contents of the buffer associated with a transfer can be viewed (or edited) by selecting the Buffer button located in the Data column of the display for each transfer.
3. Status information for each individual transfer may be viewed. This includes the message and error count and additional information.

6.3.5 Sending Acyclic Frames

- To send an Acyclic frame via the BC
  1. Right click over the **busController** in the resource tree, then select **Show BC Acyclic Frames Display**
  2. In the BC Acyclic Frames Display, select the Acyclic transfer to be sent, the press the **Send** button.



BC Acyclic Frames Display

6.4 Remote Terminal

The main function of the Remote Terminal (RT) is to provide the information, including data, for all remote terminals that will be simulated by the AIT board on the 1553 databus.

The RT is a device designed to interface with various subsystems on the 1553 databus. The interface device may be embedded within the subsystem itself, or may be an external interface to tie a non-1553 compatible device to the bus. As a function of the interface requirement, the RT receives and decodes commands from the BC, detects any errors and reacts to those errors. The RT must be able to properly handle both protocol errors (missing data, extra words, etc.) and electrical errors (waveform distortion, rise time violations, etc). RT's are the largest segment of bus components. Up to 31 remote terminals can be connected to the data bus and each remote terminal can have 31 subadresses. The remote terminal shall not speak unless spoken to first by the bus controller and specifically commanded to transmit. The commands may include data or request for data (including status) from RT's Command word, Data word and Status word formats.

Remote Terminal setup consists of setting up the following three components in the following order:

- Setup Remote Terminal
- Setup the RT Subaddress or Mode Code
- Setup the data associated with RT/SA transmission

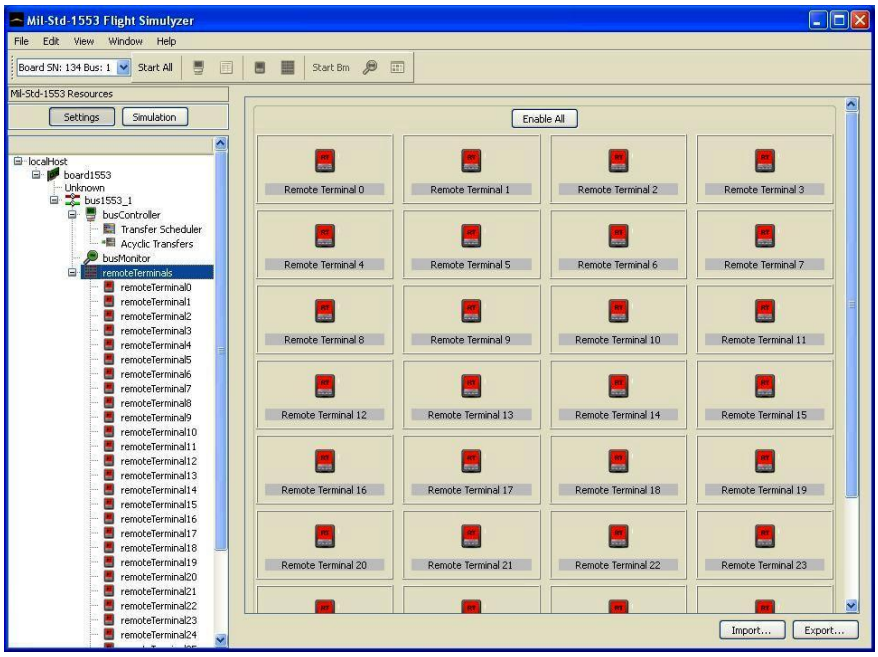
6.4.1 Remote Terminal Setup

- To setup the Remote Terminal(s):

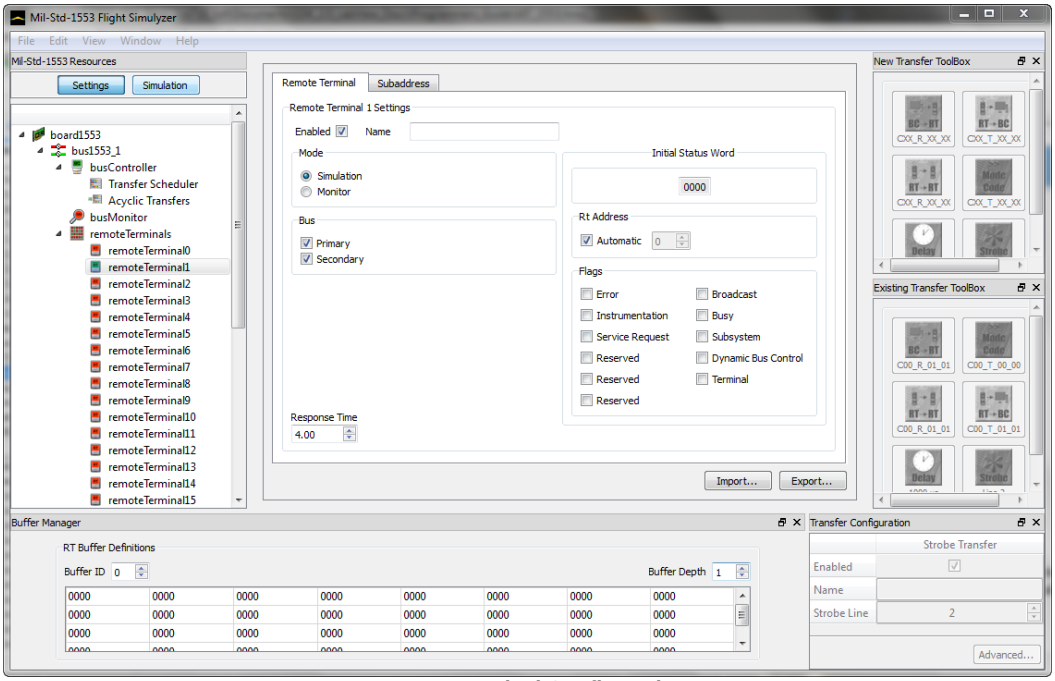
    1. Select the **Settings** button from the main screen and highlight **remoteTerminals** in the resource window. The menu tree expands and displays all 31 possible Remote Terminals that can be simulated, as seen

below:

Remote Terminal Settings



Select any of the Remote Terminal address' that you wish to simulate by selecting them in the resource window. Once you have selected the Remote Terminal, the Remote Terminal Settings windows will appear in the right pane. Check the **Enable** box to simulate the Remote Terminal.



Remote Terminal Configuration

You have the following options that can be set in this window:

Mode

- Simulation: simulate the Remote Terminal, meaning the AIT board will respond on the 1553 databus as a Remote terminal when commanded by the Bus Controller.
- Monitor: monitor all RT activity, but do not respond with an RT status word databus as a Remote terminal would when commanded by the Bus Controller. This is useful for test applications when you want to monitor RT activity, while having the “real” RT also connected to the 1553 databus.

Bus

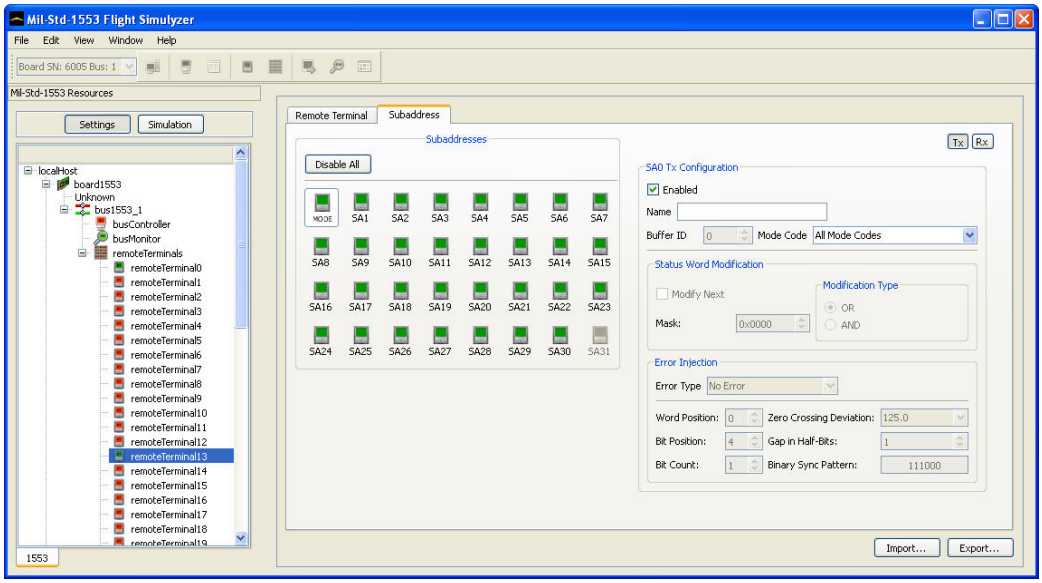
- Primary: respond on the primary bus
- Secondary: respond on the secondary bus (Note: if both are checked then respond to any command when received on either bus)
- Response Time: The time used to respond to the Bus Controller Command
- Initial Status Word: the value (in hex) of the status word response
- RT Address: the RT address that will be used in the RT response word
- Flags: the flag bits that can be optionally set in the status word response

6.4.2 Setup RT Subaddress and Mode Code

- To setup the Remote Terminal subaddress:

    1. Select the **Subaddress** folder tab. The menu page will change from the RT to the **Subaddress Settings** window, as shown below:

Figure 6.2 - Subaddress Tab



Two examples are below.

- To enable Receive Subaddress (SA) 2 to receive 3 data words by:

  1. Optionally enter a name to associate with the Subaddress transfer.

  2. Select the **SA03** icon in the left window.

  3. Select the **Rx** button in the upper right corner (choice is Tx or Rx).

  4. Check the **Enable** box.

  5. Select the **Rx Buffer Id**, and the size of the buffer to store the Received data.

- To setup RT01 SA10 to transmit 7 data words:

  1. Optionally enter a name to associate with the Subaddress transfer.

  2. Click on the **remote terminal 03** under the **remoteTerminals** resource in the left resource pane.

  3. Select the **Subaddress** tab.

  4. Select the **SA10** icon in the left window.

  5. Select the **Tx** button in the upper right corner (choice is Tx or Rx).

6. Check the **Enable** box.

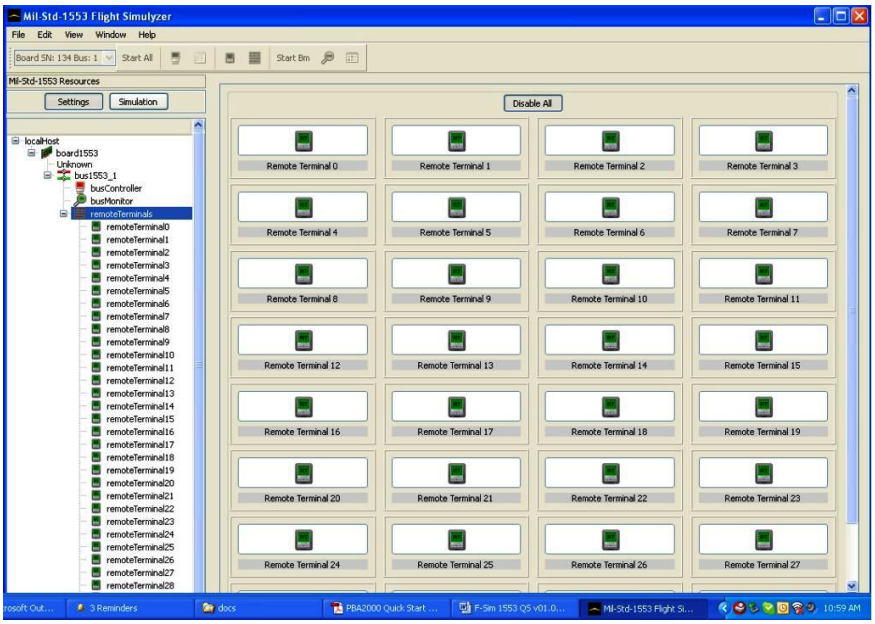
As a shortcut, it is sometimes easier to turn on all Remote Terminals and their subaddresses.

- To Enable All Remote Terminals and Subaddresses:

  1. Select the **remoteTerminals** resource in the left resource pane.

  2. Select the **Enable All** button at the top of the remote terminal display.

Figure 6.2-II - Enable All



6.4.3 Saving Remote Terminal Setup Information

The Remote Terminal setup information can be saved as either an xml file or a binConfig type file. If you highlight the **remoteTerminals** in the resource window, import and export buttons appear in the lower right hand corner.

Clicking the **Export** button will enable you to save the setup configuration of the Remote Terminals. The xml file can be edited using any xml browser/editor. The schema of the xml file is defined and documented.

The **Import** button enables you to import the Remote Terminal setup information.

6.4.4 Starting Remote Terminals

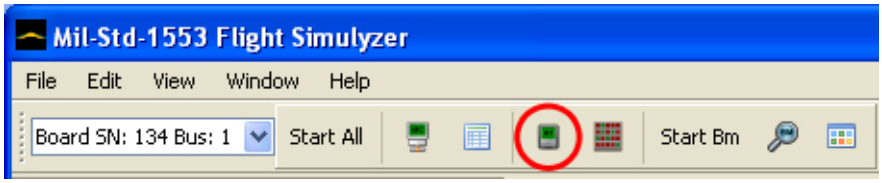
- To start a Remote Terminal simulation:

  1. Press the **Simulation** button. The 1553 resources screen enables you to start all configured RT's by doing one of the following:

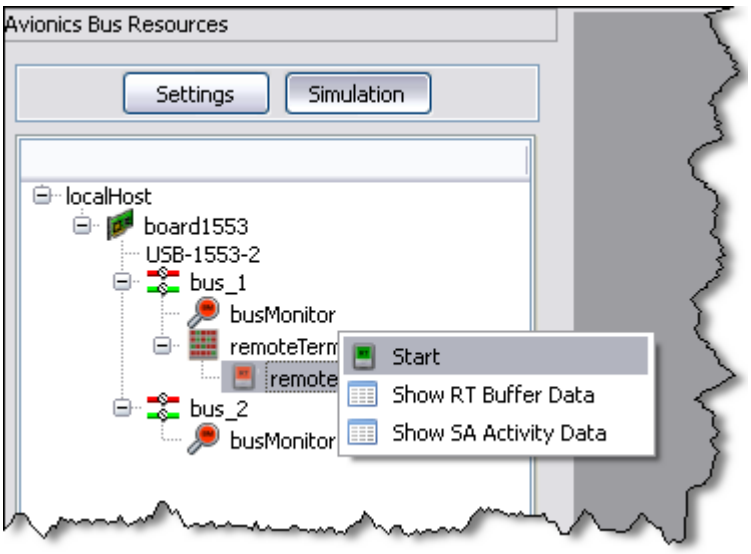
     - Right click on the **remoteTerminals** node in the resource tree, and select **Start RT's**.

     - Click on the **Start RT's** icon in the Menu Bar, shown in the red circle below.

Remote Terminal Icon

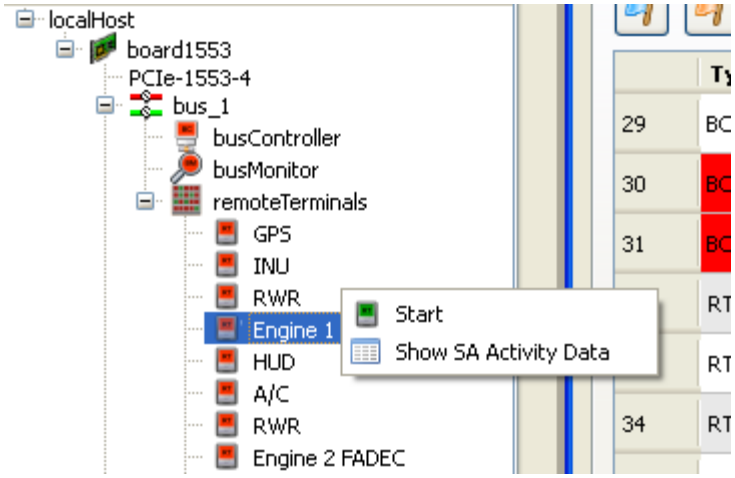


Alternatively, individual RT's can also be started by right clicking the corresponding RT in the resource tree and selecting **Start.**

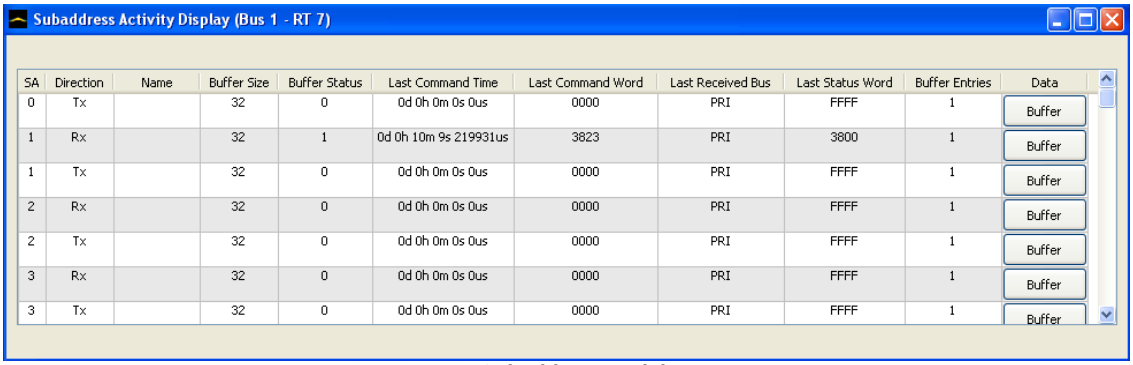


6.4.5 Operating the RT's

Each of the configured Remote Terminals can be individually controlled by right clicking over the RT in the resource tree.



Each RT can be individually stopped or started from the RT Right Click menu.
The transfers set up on an RT can be viewed via the SA Activity Data option:



RT Subaddress Activity

6.5 Bus Monitor

The main functions of the Chronological Bus Monitor (BM) are listening and capture all the information, including errors, on the 1553 databus.

The BM is passive and collects data for real-time or post capture analysis. The BM can store all or portions of traffic on the bus, including electrical and protocol errors. BMs are primarily used for instrumentation and data bus testing. Up to 10 triggers are provided which can be used in any combination to identify/capture specific

command/status/data words or error conditions detected on the bus or start capture upon an external trigger received via an external digital input. Filters are provided to command the BM to ignore specific RTs or Subaddresses (Tx, Rx or both directions).

The **default** BM setup is set to **trigger on any data word or error received on the bus**.

Setup of the Bus monitor is not required if you just want to capture all 1553 databus activity.

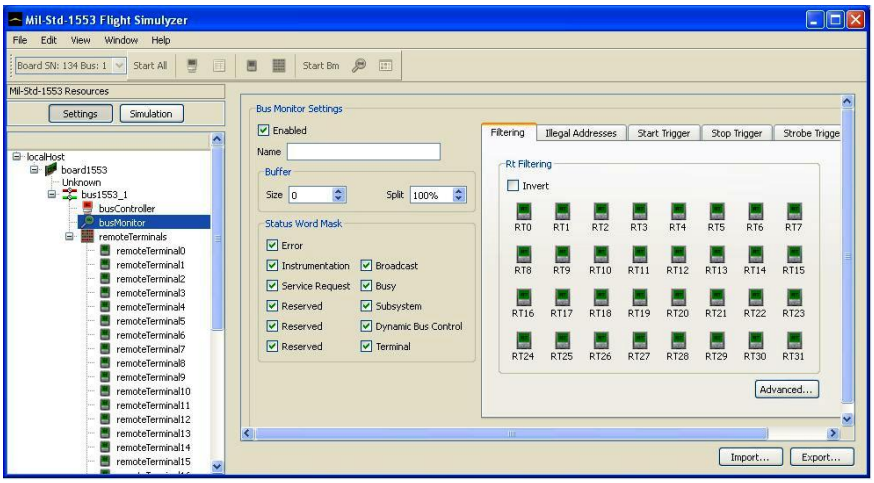
6.5.1 Bus Monitor Filter Setup

- To setup the Bus Monitor Filters:

  1. Highlight the **busMonitor** in the right resource pane.

  2. Select the **Filtering** tab in the right **Bus Monitor Settings** pane.

Bus Monitor Settings

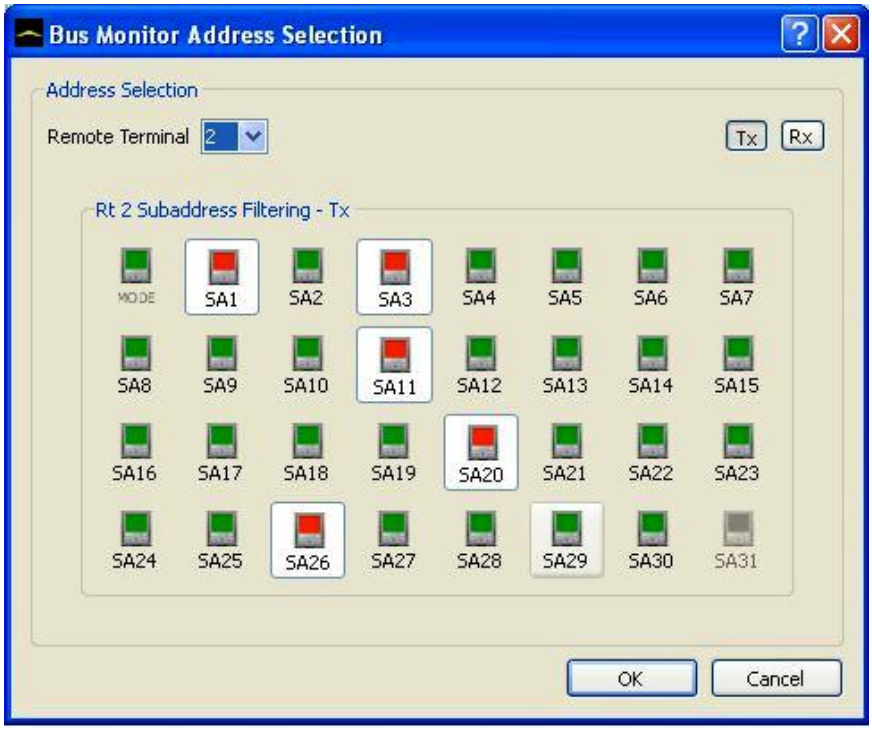


The **default** is enabling **all of the RTs to be captured**.

The **Invert** box will invert the values of the RTs (i.e. from captured to non-captured state).

Select any RT and the **Advanced** button to further select capture of RT subaddress from Tx and Rx, or both.

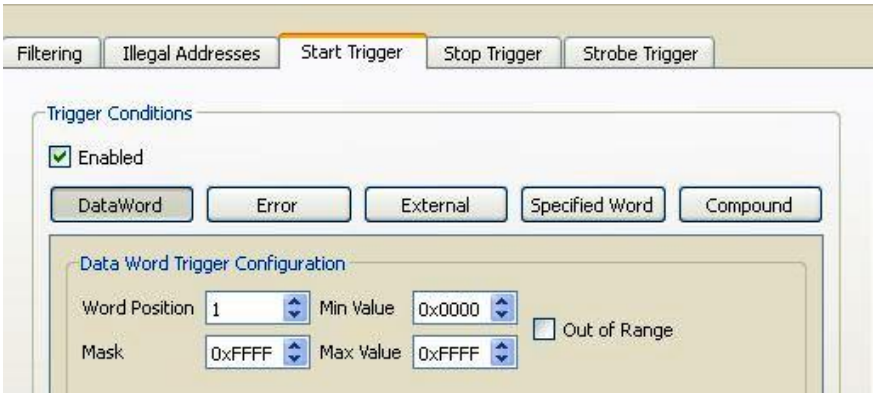
Bus Monitor Address Selection


Bus Monitor Address Selection
Address Selection
Remote Terminal
2
Tx
Rx
Rt 2 Subaddress Filtering - Tx
MODE
SA1
SA2
SA3
SA4
SA5
SA6
SA7
SA8
SA9
SA10
SA11
SA12
SA13
SA14
SA15
SA16
SA17
SA18
SA19
SA20
SA21
SA22
SA23
SA24
SA25
SA26
SA27
SA28
SA29
SA30
SA31
OK
Cancel

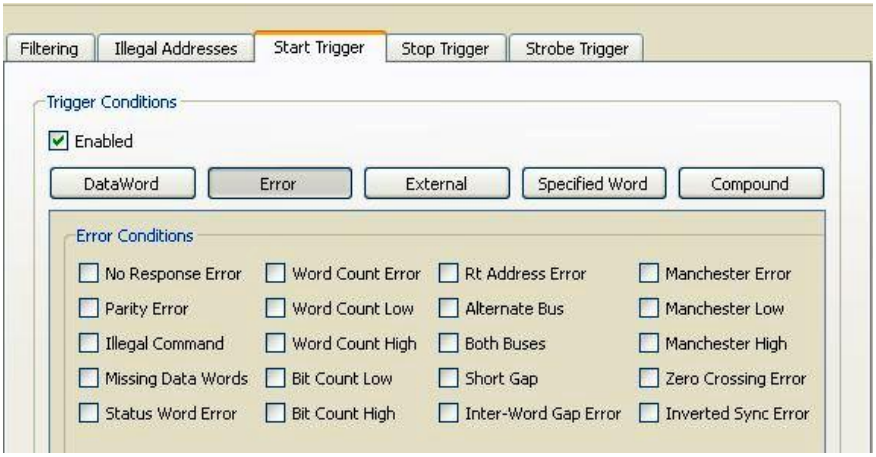
6.5.2 Choosing and Configuring Start/Stop Triggers

The **Start Trigger** and **Stop Trigger** tabs in the **Bus Monitor Settings** pane enables you to configure trigger conditions that may be used to start or stop the collection of data by the Bus Monitor. There are four types of trigger conditions that may be defined. They are:

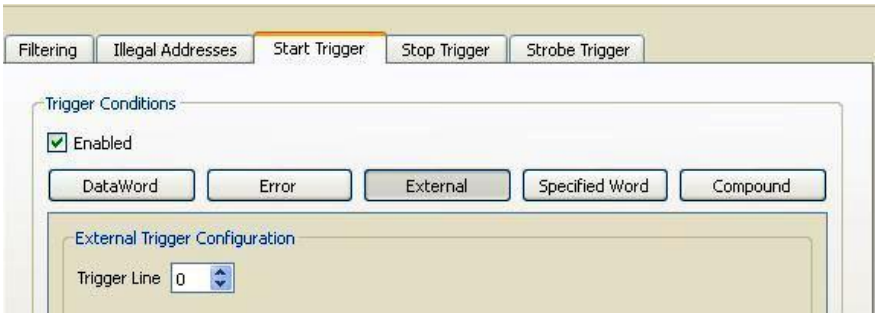
- Data Word: selecting a dataword, or a portion of a dataword, or an out of range value as a trigger condition to the Bus Monitor.



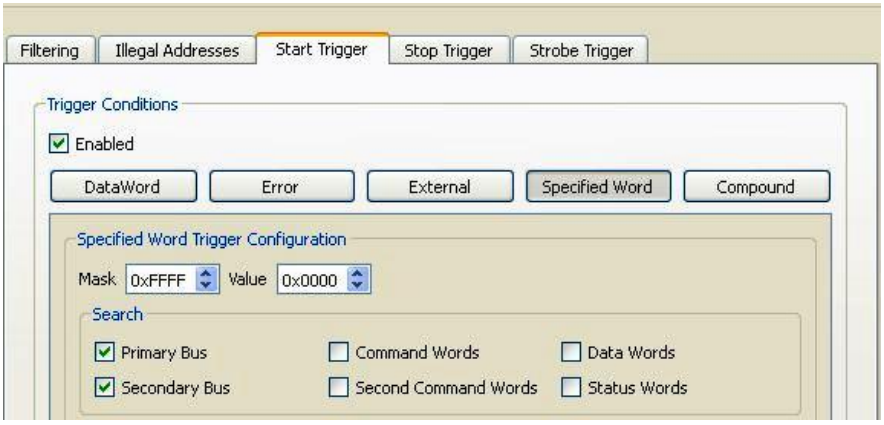
- Error: selecting an error(s) as a trigger condition to the Bus Monitor.



- External: selecting an external digital input as a trigger condition to the Bus Monitor.



- Specified Word: selecting an exact match of a word on the 1553 databus as a trigger condition to the Bus Monitor.



The **Compound** tab is used to define multiple triggers linked together in an “and” condition.

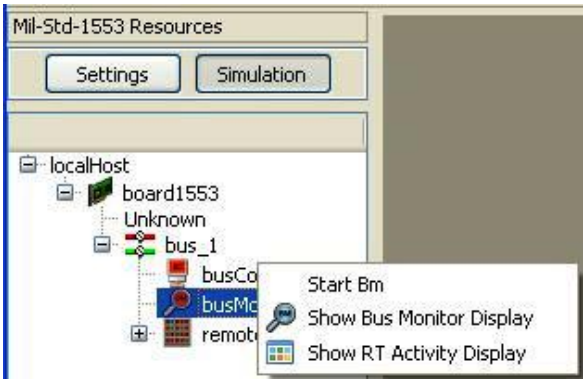
The **Strobe** tab is used to define trigger conditions from data on the 1553 that result in an output strobe over a specified discrete.

6.5.3 Starting the Bus Monitor

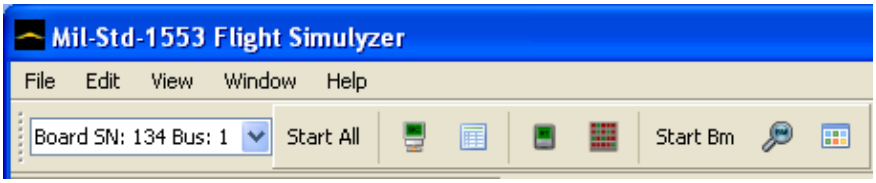
- To start the Bus Monitor:

  1. Press the **Simulation** button. The 1553 resources screen enables you to start the Bus Monitor by doing one of the following:

     - Right click on **busMonitor** in the resource pane, and choose **Start BM**.



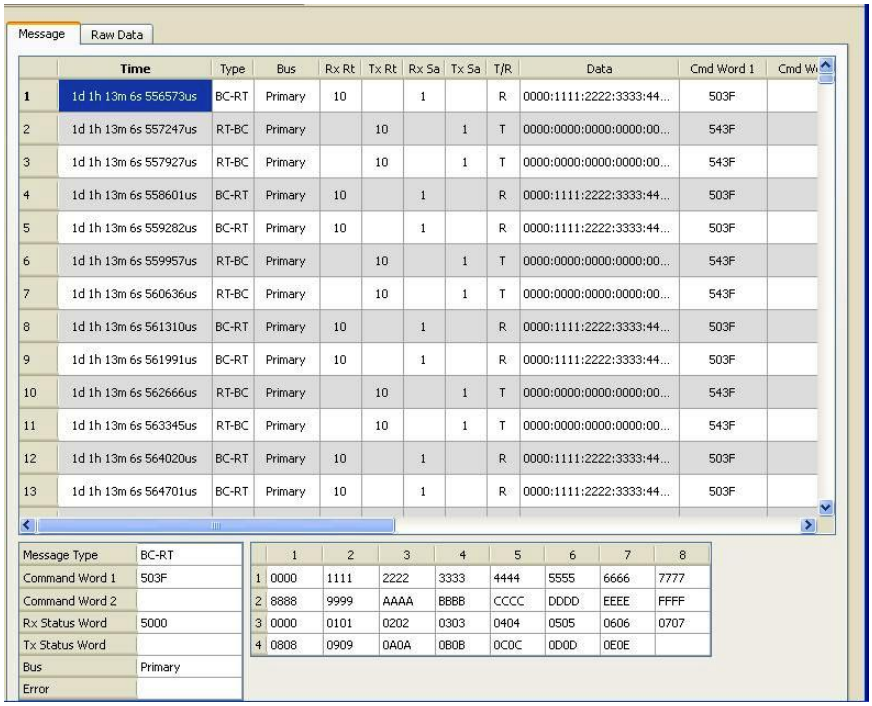
     - Click on the **Start BM** icon in the Menu Bar.



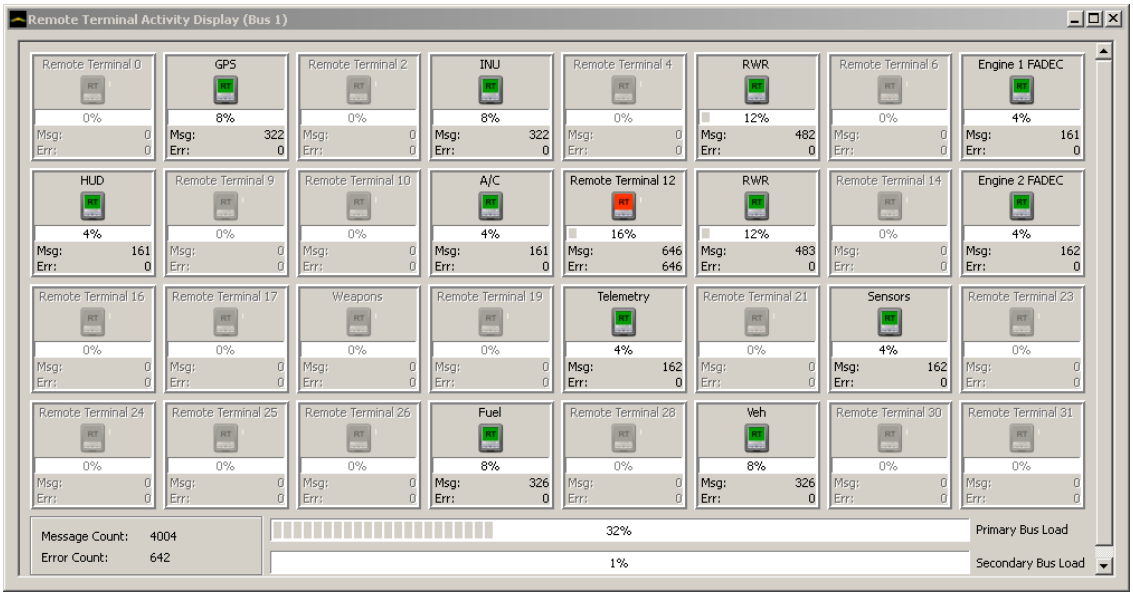
Once the Bus Monitor is started, you can look at the activity of all the RTs on the 1553 databus by selecting the **Show RT Activity Display**.

To enable the Chronological Bus Monitor, simply select the **Show Bus Monitor Display** or use the icon from the toolbar.

Chronological Bus Monitor Display

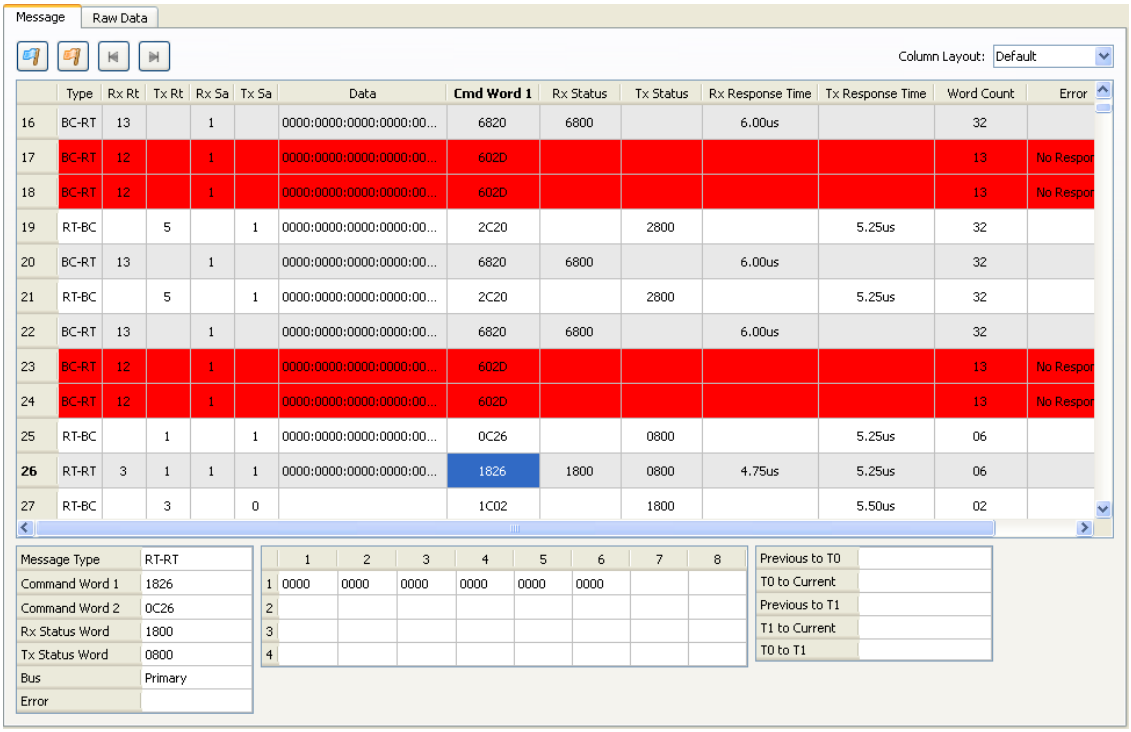


The Bus Monitor also provides an RT Activity display which depicts the current status of the active RT's detected on the bus. This display may be accessed by selecting **Show RT Activity Display** from the Right-click menu for the **busMonitor** in the resource tree. This display is also accessible via a toolbar button.



6.5.4 Bus Monitor Table

The Bus Monitor Table provides the user with an easy to read data layout and several options for viewing and navigating data:

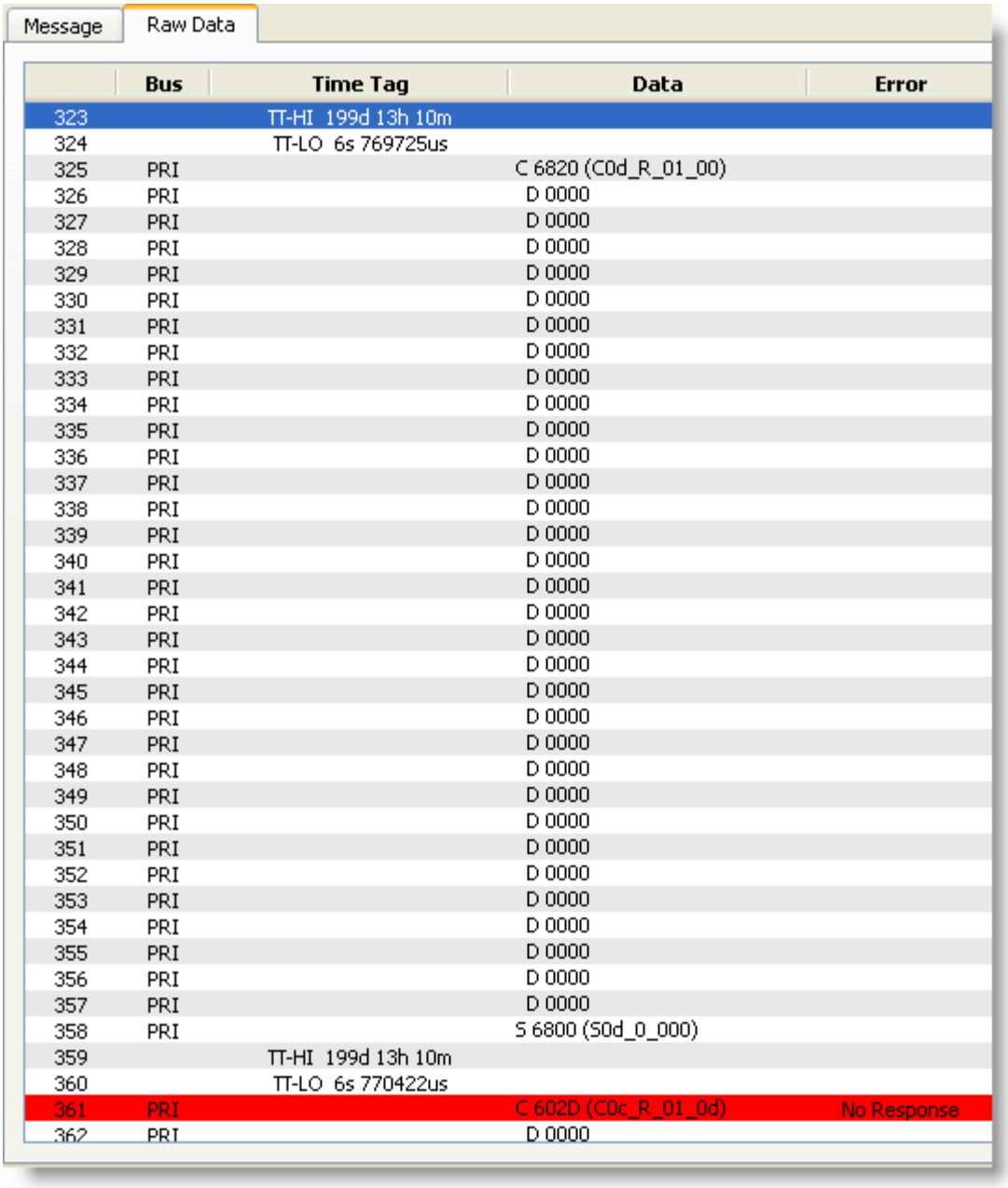


- Data is sorted in the table by timestamp and the table provides various data columns that can be hidden/shown. To show/hide a column, right click on any column header and check/ uncheck
  the desired columns. When done, click anywhere off the menu and the columns will update.

Column layouts can also be created to store favorite views, using the Column Layout drop down menu.

- The flags in the upper left portion of the table (as well as the right click menu) will allow setting a T0 and a T1 marker that indicates the time delta between selections (bottom right).
- The left and right arrow keys allow jumping between Start triggers in the table.
- Each message (when selected) is shown in a break down table (bottom left and bottom middle), that shows message control data as well as data payload.

Selecting the Raw Data tab displays the following table:



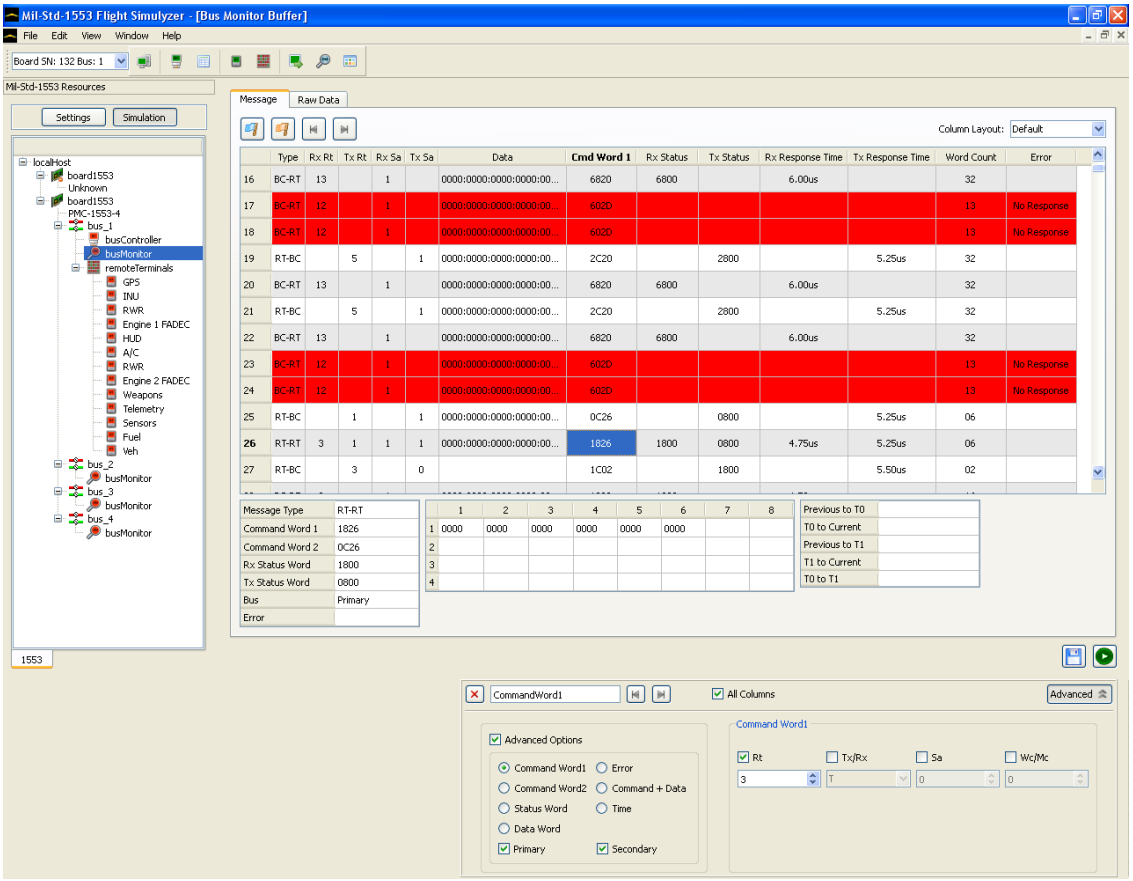
The Raw Data table shows the same data in a data word format. This view allows viewing network specific data, such as which network each word was received upon.
This view also shows the word at which errors were detected during data capture. Clicking between the two data views is synchronized in order to easily provide a
means to move back and forth between the views for analyzing specific messages.

6.5.4.1 Bus Monitor Capture Searches

The Bus Monitor Capture display is searchable.

Standard Data Table

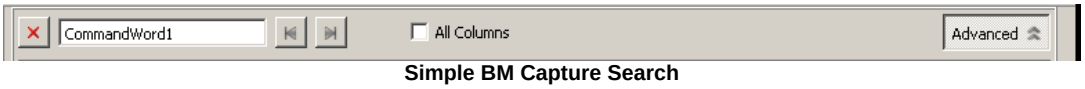
- To access the Search Tool used to search the BM capture data:
  1. Select Edit | Find from the menu (or Ctrl+F). This will cause the Search Tool to appear at the bottom of the Flight Simulyzer window. Note that the search tool is only available when F-SIM is in Simulation mode and the Bus Monitor table is the currently active window.



BM Search Tool

The search tool provides many options to execute easy searches of the captured data.

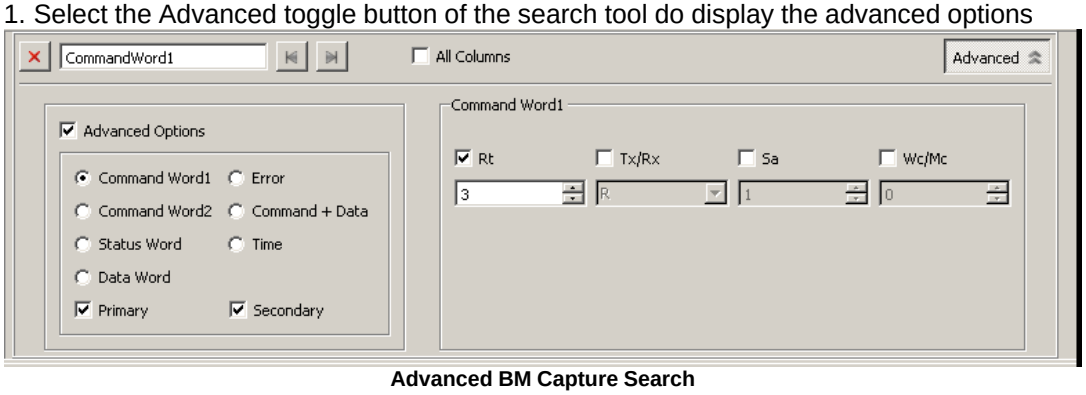
- To search a column of the capture display for a value:
  1. Select the column header or a cell in the desired column.
  2. In the search tool edit box, enter the value to search for



Simple BM Capture Search

  3. Press the arrow buttons to search forwards and backwards for the value.

- To execute a complex capture search:
  1. Select the Advanced toggle button of the search tool do display the advanced options



Advanced BM Capture Search

  2. Select the **Advanced Options** check box
  3. Select the bus transfer field to search. Possible fields are:
     - Command Word1/Word2
     - Status Word
     - Data Word
     - Error
     - Command + Data
     - Time
  4. Enter the data/criteria to search for.
  5. Optionally collapse the advanced search data by clicking the advanced button again
  6. Press the arrow buttons to search forwards or backwards

Raw Data Table

Raw data searches provide simple search functionality only, jumping to specific values found in the table.

- To access the Search Tool used to search the BM capture data:
  1. Select Edit | Find from the menu (or Ctrl+F). This will cause the Search Tool to appear at the bottom of the Flight Simulyzer window. Note that the search tool is only available when F-SIM is in Simulation mode and the Bus Monitor table is the currently active window.

  2. Enter the search term, optionally check the search All Columns checkbox, and then click the forward or back buttons.

To hide the Search Tool, press the escape button or click the red X in the left hand corner of the dialog.

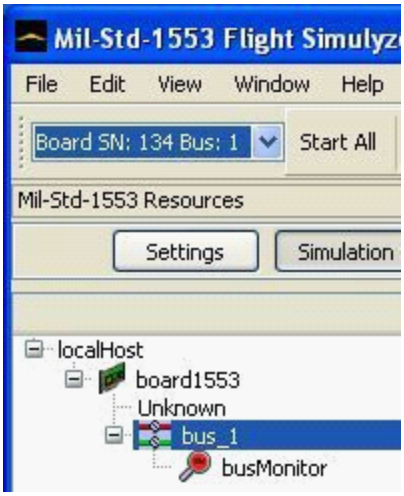
6.6 Running A Simulation

As long as licensed hardware is available in the system (see Detecting hardware), a simulation can be started in various ways. By default on startup, *Flight Simulyzer* will be configured to simulate a Bus Monitor on each available channel. Otherwise, configure the hardware in the *Settings* perspective based on your requirements and then go to the *Simulation* perspective by clicking the Simulation button.
To begin using *Flight Simulyzer*, double click on the *Flight Simulyzer* icon that was

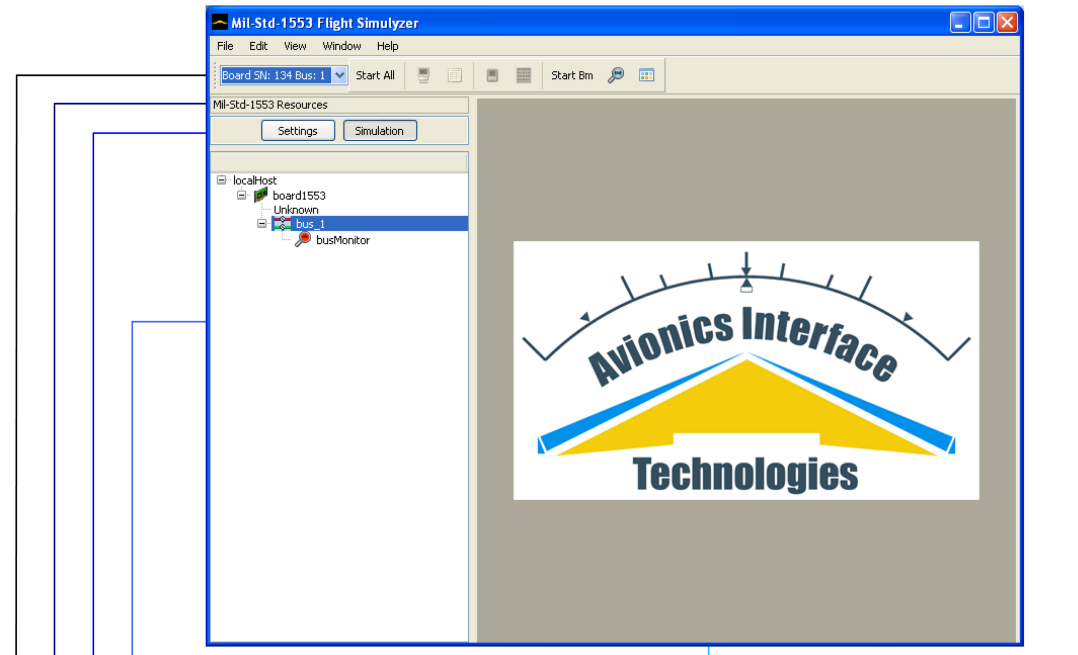
placed on the Windows desktop or select *Flight Simulyzer* from **Start | All Programs | Avionics Interface Technologies | MIL-STD-1553 SDK vxx.xx.xx | Flight Simulyzer**.

Once *Flight Simulyzer* has been started, the **Main** graphics window is displayed. The software should automatically find the 1553 hardware. The status displayed looks like the example in the figure below. If no hardware is found, the correct license may not be installed correctly, or the "-ntg" mode is on, call AIT for support.

Main Window



***Flight Simulyzer* Window Layout**



Status

Detailed resource information based on the databus resource, this window changes for every function (i.e. BC, RT, and Bus Monitor)

Resource Status

Contains visual system information for the 1553 databus resource, in Simulation Mode displays the 1553 databus status

Settings

Settings button is used to setup the BC, RT, BM of the selected bus, Simulation button is used to start/stop the selected 1553 bus

Resource Display

Provides information about the resources found in the system and listed in Resource Status window

Menu Bar

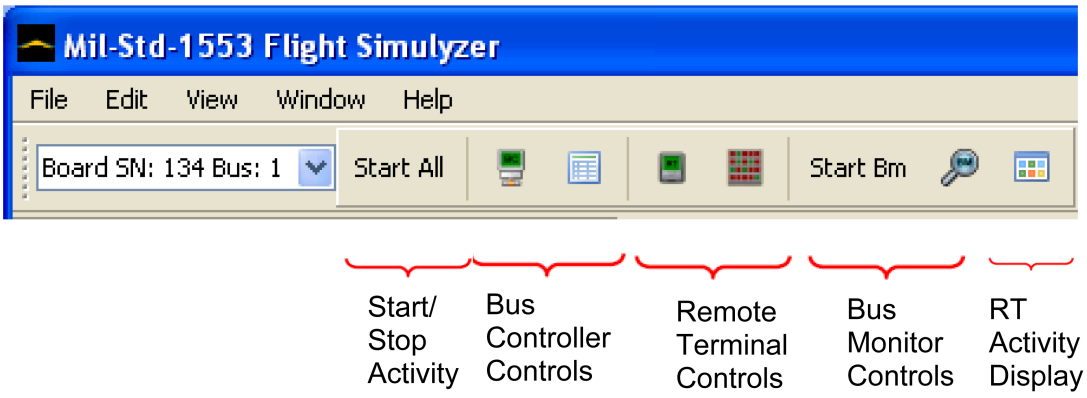
Provides all menu functions available for operations, also indicates the 1553 hardware found and available

6.6.1 Menu Bar

The Menu Bar provides access to **all** functions available for operation of the *Flight Simulyzer* Analyzer software. The Menu Button Bar has **quick access** icon groups available for the most commonly used functions. The Menu Bar and Menu Button Bar are shown below.

The Menu Buttons provide one-click access to setup BC, RT and BM functions, as well as Start/Stop activity and Display Remote Terminal Activity.

Menu Bar



7 Notes

7.1 Terms

Bandwidth Allocation Gap: The maximum rate at which data can be sent on a VL in an AFDX network.

Broadcast: Commands sent to multiple RT's at once. The RT's are responsible for distinguishing between broadcast and non-broadcast command messages
An RT address of 11111 (31) indicates a broadcast message

Data Buffer: An area of memory on the 1553 device (global RAM) assigned by the programmer to accommodate 1553 transfer(s) to/from the BC or RT (2047 data buffers available)

Driver Command: Command used by the AIT Target Software to control the 1553 device

Dual Stream: Indicates the AIT 1553 board supports two dual redundant MIL-STD-1553 data streams

FLASH: Page-oriented electrical erasable and programmable memory intermessage gap the time between 1553 message transmissions with a minimum gap time, as specified in MIL-STD-1553, of 4.0 microseconds

Interrupt: A signal from a device attached to a computer or from a program within the computer that causes the main program that operates the computer (the operating system) to stop and figure out what to do next

RT Monitoring: In this mode, the RT will capture RT message data on a subaddress level without affecting bus traffic (i.e. without generating a response on the bus). This mode is used to monitor non-simulated "external" RTs.

Mac Address: Media Access Control Address. A source or destination address. As a destination address, this value is used for routing frames in an ethernet network. In AFDX, the lower 16-bits of this value
(the VL Id) is used for routing.

Major Frame: Sequence of minor frames defined for transfer (max 64 minor frames in a major frame)

MIL-STD-1553: Military specification defining a digital time division command/response multiplexed databus

Minor Frame: Sequence of 1553 transfers (max 128 transfers defined in a minor frame)

Mode Code: Unique five bit codes that are sent to specific RT's to check their status, control their operation and manage the bus.

Response Time: The time between the BC Command/Data word and the RT Status word

Response Timeout: The maximum time the Bus Controller will wait for a Status word

Value: Response from the RT before indicating a "Response Timeout"

Single Stream: Indicates the AIT 1553 board supports one dual redundant MIL-STD-1553 data stream

Status Word: 1/2 For RT-to-RT transmissions, Status Word 1 is the status word sent by the transmitting RT, Status Word 2 is the status word sent by the receiving RT

Strobe: A strobe is a signal that is sent that validates data or other signals on adjacent parallel lines

Transfer Type: BC-to-RT, RT-to-BC, RT-to-RT

Vector Word: Transmitted by the RT when requested by the BC with the Mode Code command "Transmit Vector Word" which is Mode code 16, the vector word will contain information indicating the next action to be taken by the BC

Virtual Link: A VL (the lower 16-bits of a Destination Mac Address) is utilized by an AFDX network for routing packets to End Systems.

7.2 Acronyms and Abbreviations

ADC	Analog to Digital Converter
AFDX	Avionics Full Duplex Databus
ALBI	Local Bus Interface
ANSI	American National Standards Institute
ARINC	Aeronautical Radio, Incorporated
ARM	Advanced RISC Machine
BAG	Bandwidth Allocation Gap
BC	Bus Controller
BIP	Bus Interface Processor
BIU	Bus Interface Unit
CM	Chronological Bus Monitor
cPCI	Compact PCI
CPLD	Coupled
CPU	Central Processing Unit
DAC	Digital to Analog Converter
DC-DC	Direct Current to Direct Current (power conversion)
DIP	Data Interface Processor
DMA	Direct Memory Access
DRAM	Dynamic Random Access Memory
DSUB	D-Subminiature
EDO	Enhanced Data Output
EEPROM	Electrically Erasable and Programmable Read Only Memory
EPROM	Erasable Programmable Read Only Memory
ES	End System
FIFO	First in/First out
FLASH	Page oriented electrical erasable and programmable memory
FPGA	Field Programmable Gate Array
GND	Ground
IEEE	Institute of Electric and Electronic Engineers
IRIG	Inter Range Instrumentations Group
IRIG-B	Inter Range Instrumentations Group Time code Format Type B
I/O	Input/Output
LCA	Logic Cell Array (XILINX - Programmable Gate Array)
LED	Light-emitting Diode
MAC	Media Access Control
MIL-STD	Military Standard
µsec	microsecond
OWL	Object Wrapper Library
PC	Personal Computer
PCI	Peripheral Component Interconnect
PCIe	Peripheral Component Interconnect Express
PMC	PCI Mezzanine Card

PROM	Programmable Read Only Memory
PSC	PCI and System Controller
PXI	PCI Extensions for Instrumentation
PXIe	PCI Extensions for Instrumentation Express
RAM	Random Access Memory
RISC	Reduced Instruction Set Computer
RMW	Read-Modify-Write
RS-232	Recommended Standard No.232 (US-Norm)
RT	Remote Terminal
RTPTP	Remote Terminal Production Test Plan
RXD	Received Data
SDK	AIT's Software Development Kit
SIMM	Single Inline Memory Module
SRAM	Static Random Access Memory
SSRAM	Synchronous Static Random Access Memory
TBD	To be determined
TCP	Time Code Processor
TTL	Transistor-Transistor Logic
TXD	Transmitted Data
UART	Universal Asynchronous Receiver and Transmitter
USB	Universal Serial Bus
VL	Virtual Link
VME	VERSAmodule Eurocard
VME64	VME 64bit extension
VXI	VME Extensions for Instrumentation
XMC	PCI Express Mezzanine Card